

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-271788

(43)Date of publication of application : 09.10.1998

(51)Int.Cl.

H02K 23/26

(21)Application number : 09-070168

(71)Applicant : MITSUBISHI ELECTRIC CORP
MITSUBISHI ELECTRIC HOME
APPLIANCE CO LTD

(22)Date of filing : 24.03.1997

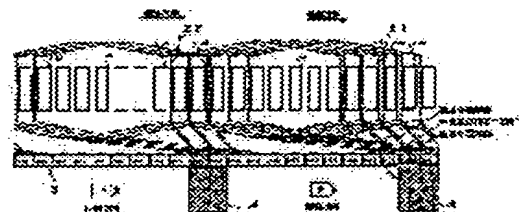
(72)Inventor : TAKAHASHI YUJI
OTAKA SHUICHI
ARAI MITSUO

(54) COMMUTATOR MOTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To attain high efficiency by reducing a copper loss without enlarging a wire diameter of an armature winding, by winding the single armature winding, wound at least one time relating to each pair of slots of an armature core with a winding start tin a symmetric position, around over a slot total periphery of the armature core.

SOLUTION: Armature windings 2-1, 202 with winding starts in symmetric positions are simultaneously wound, the winding start of the winding 2-1 is connected to a commutator segment 3-1, with the winding in slots 1-1, 1-10 connected to a commutator segment 3-2. The winding 2-2 is connected to a commutator segment 3-12, with the winding in slots 1-12, 1-21 connected to a commutator segment 3-13. Similarly winding over a haft periphery of a slot 1, the winding 2-1 connected to the commutator segment 3-12, and the winding 2-2 is connected to the commutator segment 3-1. Thus by winding the armature winding 2-1 and 2-2 over the total periphery of the armature core slot 1, without thickening a wire diameter of the armature winding, high efficiency by reducing a copper loss can be attained.



LEGAL STATUS

[Date of request for examination]

30.07.2001

[Date of sending the examiner's decision of

rejection]

[Kind of final disposal of application other than the
examiner's decision of rejection or application
converted registration]

[Date of final disposal for application]

[Patent number] 3433370

[Date of registration] 30.05.2003

[Number of appeal against examiner's decision of
rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] A revolving shaft and the armature core with two or more slots of N connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the slot of an armature core, and the commutator segment of the same number, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding by which the coil was carried out at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding to which the coil of the start of a volume was carried out once [at least] to a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. A coil is carried out one by one to the N/2nd opposite slots. After the N/2nd coils for a slot each armature winding -- and the commutator motor which carries out a coil one by one to the N/2nd opposite slots further, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

[Claim 2] the above-mentioned commutator motor -- setting -- an armature -- all -- a conductor -- the commutator motor given in the 1st term of a claim characterized by setting up so that the ratio of a number and the number of field windings may become six or more.

[Claim 3] The commutator motor given in the 1st term of a claim characterized by setting up the phase angle of the core of said armature winding, and the core of the field pole in the above-mentioned commutator motor so that it may come among 10 degrees - 30 degrees.

[Claim 4] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots which have the start of a volume in the position of symmetry, respectively, respectively continuously to the next commutator segment. To the N/2nd opposite slots, carry out a coil one by one and a coil is carried out one by one to the N/2nd opposite slots. after the N/2nd coils for a slot -- each armature winding -- and the commutator motor which carries out a coil one by one to the N/2nd opposite slots further, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

[Claim 5] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the slot of an armature core, and the commutator segment of the same number, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding by which the coil was carried out at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding by which the coil of the start of a volume was carried out once [at least] to 2 juxtaposition by carrying out to the number of a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. The commutator motor which carries out a coil one by one to the N/2nd opposite

slots, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to $N / \text{the } 2+1\text{st}$ commutator segments, respectively.

[Claim 6] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the commutator segment of a twice [more than] as many integral multiple as this to the slot of an armature core, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding to which the coil only of the number was carried out to the number of slots to the number of a pair each of slots which have the start of a volume in the position of symmetry, respectively in two or more lines of the same number as the commutator segment of an integral multiple, respectively continuously to the next commutator segment. The commutator motor which carries out a coil one by one to the $N/2\text{nd}$ opposite slots, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to $N / \text{the } 2+1\text{st}$ commutator segments, respectively.

[Claim 7] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the slot of an armature core, and the commutator segment of the same number, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding by which the coil was carried out at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding to which the coil of the start of a volume was carried out once [at least] to a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. Carry out a coil one by one to the $N/2\text{nd}$ opposite slots, and it once cuts after the $N/2\text{nd}$ coils for a slot. It starts from the place which carried out [predetermined *****] the volume start of each armature winding from it. The commutator motor which carries out a coil one by one from the location which was able to be shifted to the $N/2\text{nd}$ opposite slots, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to $N / \text{the } 2+1\text{st}$ commutator segments, respectively.

[Claim 8] The 1st term of a claim characterized by for the 1st time and the 2nd number of turns being the 1st time $>$ the 2nd time in the armature winding within the slot of a pair, and the coil ratio being 1.1-1.4 in the above-mentioned commutator motor, or a commutator motor given in the 7th term of a claim.

[Claim 9] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots which have the start of a volume in the position of symmetry, respectively, respectively continuously to the next commutator segment. Carry out a coil one by one to the $N/2\text{nd}$ opposite slots, and it once cuts after the $N/2\text{nd}$ coils for a slot. It starts from the place which carried out [predetermined *****] the volume start of each armature winding from it. The commutator motor which carries out a coil one by one from the location which was able to be shifted to the $N/2\text{nd}$ opposite slots, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the $N+1\text{st}$ commutator segments, respectively.

[Claim 10] The 4th term of a claim characterized by for the 1st time and the 2nd number of turns being the 1st time $>$ the 2nd time in the armature winding within the slot of a pair, and the coil ratio being 1.1-1.4 in the above-mentioned commutator motor, or a commutator motor given in the 9th term of a claim.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the commutator motor used for rotating equipments, such as a vacuum cleaner and a power tool.

[0002]

[Description of the Prior Art] A commutator motor in recent years shows the inclination of small and a high increase in power, and thick wire-ization of an armature winding for the commutator motor which iron loss reduction also according [the engine-performance technical problem for which the armature used for it is asked] to a core configuration, core grade, and a board thickness improvement, and the copper loss reduction by armature-winding improvement are called for, and is used especially for a vacuum cleaner to search for a well head is advanced.

[0003] Drawing 26 For example, the coil schematics of the conventional commutator motor shown in JP,6-38704,B, The armature side elevation of the commutator motor of the former [drawing 27 / R> 7], the enlarged drawing of the partial cutting plane of the armature core slot of the commutator motor of the former [drawing 28], The commutator connection section partial enlarged drawing of the commutator motor of the former [drawing 29], drawing where drawing 30 looked at a conventional field core and a conventional armature core from the top, The armature commutator section plan of the commutator motor of the former [drawing 31], the armature commutator section side elevation of the commutator motor of the former [drawing 32], It is drawing of the coil injection section of the flyer winding machine with which the armature commutator section bottom view of the commutator motor of the former [drawing 33] and drawing 34 perform the partial enlarged drawing of drawing 33 , and drawing 35 performs an armature winding.

[0004] In 1, in drawing, 1-1--1-12 expresses the slot number with an armature core slot. An armature winding 2 is looped around into said armature core slot 1. 3 expresses a commutator segment and 3-1--3-24 expresses a commutator-segment number. 4 a commutator and 6 for a carbon brush and 5 The commutator coil connection section (henceforth "a hook"), 7 an armature core end-face insulating member and 9 for an armature core and 8 An armature core slot insulation member, The insulating member to which an armature winding holds 10 with a centrifugal force so that it may not jump out of an armature core slot For a revolving shaft and 13, as for a field winding and 20, a field core and 14 are [organic liquids and solutions, such as a varnish with which (it is hereafter called a "wedge") and 11 carry out insulating fixing of the armature winding, and 12 / the form of a winding machine and 21] the pin center, large guides of a winding machine.

[0005] Next, actuation of the conventional example is explained. A commutator 5 is alpha hook type by a diagram, and the number of commutator segments 3 shows the case where the number of 24 and the armature core slots 1 is 12. In the revolving-shaft section 12 connected with the both-ends side of the armature core slot 1 with 12 slots connected to the revolving shaft 12, and this both-ends side, the armature core end-face insulating member 8 made in resin, papers, etc., such as PET and PBT, is arranged. Moreover, inside the armature core slot 1, the armature core slot insulation member 9 made in polyester film, paper, etc. is arranged. The commutator 5 is equipped with the armature core slot 1 and the twice as many commutator segment 3 as this.

[0006] Usually, the armature winding 2 by which the coil was carried out in piles two or more times while being contained by coincidence in 1-7 and 1 -12 [the armature core slot 1-1 and 1-6, and] an armature winding 2-1 and 2-2 with two coil flyers of a winding machine Connection is carried out with twisting termination in the shape of alpha after a coil at the hook 6 of a commutator 5 (alpha-hook method). The coil of the two armature windings 2 is continuously carried out to the following armature core slot 1 with two coil flyers one by one, respectively. Twelve armature windings 2 looped around over the perimeter constitute an armature coil, and an armature is constituted so

that it may count from the start of a volume, respectively and the terminal of an armature winding 2 may be connected to the 13th commutator segment 3. Heat joining connection of said hook 6 is made with an armature winding 2 in fusing after armature connection termination, pressurizing hook 6.

[0007] However, as shown in drawing 34, the rigidity of an armature winding 2 is strong, on both sides of hook 6, when the coil of the armature winding 2 beyond wire-size $\phi 0.5$ is carried out to the shape of alpha, since the wire size is thick, since R of the flexion of an armature winding 2 *****s greatly, a conductor spacing with the ***** hook 6 cannot be secured, but poor insulation tends to happen. Moreover, since a high current flows and welding pressure also becomes strong in order to carry out heat welding compared with a thin line, in case fusing of the thick wire is carried out, they are a lifting and a cone in poor fusing and a poor open circuit. Furthermore, if a wire size becomes thick, since the rigidity of an armature winding 2 is strong, the problem that hook 6 will deform at the time of a coil will also be generated.

[0008] Moreover, as shown in drawing, when a wire size is thick, the rigidity of an armature winding 2 is strong, and since a coil tension does not fully start, either, a coil cannot be coiled with the diameter of min. There is also a possibility that the insertion tooth space of a wedge 10 may be lost by expansion of the space factor by thick-wire-izing within the armature core slot 1. Furthermore, since the coil section between a commutator 5 and the armature core slot 1 becomes large, if it flows down the varnish 11 which carries out insulating fixing of the armature winding 2, a possibility of this varnish 11 flowing into commutator 5 front face, and causing poor rectification will arise. Moreover, there is a possibility that it is necessary to inspect visually the conductor spacing after the thick wire connection in hook 6, and may be connected also with the productivity slowdown by the increment in a man day.

[0009] Moreover, it is a thing inserted in the armature core slot 1 which formed the form 20 attached in the end of the main shaft which fixed the flyer (not shown) to the position of a winding machine like drawing 35, wound the armature winding 2 along with this form 30 and centre guide 21, and was formed in the peripheral face of an armature core 7, and an armature winding 2 is guided to the armature core slot 1 from the include angle which inclined 15 degrees **10 degrees from the pin center, large along with form 20. It was fixed to the chuck (not shown) which pinches an armature core 7, and when an armature carries out the index of such forms 20 the middle so that an armature winding 2 can be coiled to the last slot, they have established recess so that form 20 may not interfere in a coil end. Therefore, form 20 can guide an armature winding 2 only to the inlet port of the armature core slot 1, but as for the armature winding 2 which flew from the tip of form 20, slackens, and will be in a free condition in the armature core slot 1. The opening width beta of the armature core slot 1 has a possibility that an armature winding 2 may contact opening of the armature core slot 1, and may cause processing degradation, when the wire size of the armature winding 2 which it lets out from a flyer is more than $\phi 0.5\text{mm}$, since it becomes a value near $\beta/2$ in practice with a coil injection include angle.

[0010]

[Problem(s) to be Solved by the Invention] Since the coil approach of the armature winding of the conventional commutator motor is constituted as mentioned above Although there is [a wire size of an armature winding 2] no problem in the thing of the comparatively thin wire size not more than $\phi 0.45\text{mm}$, the wire size of an armature winding 2 about the coil beyond $\phi 0.5\text{mm}$ The trouble on quality -- stabilizing and securing becomes difficult and the conductor spacing in the hook 6 of an armature winding 2 has poor fusing and the open circuit to hook 6, deformation of hook 6, and a possibility that an armature winding 2 may contact opening of the armature core slot 1, and may cause processing degradation -- increases. furthermore, the evil by a wound diameter becoming large by thick wire-ization again -- happening -- in addition -- and it is necessary to inspect the conductor spacing after armature-winding connection visually, and is connected also with the productivity slowdown by the increment in a man day.

[0011] This invention was made in order to solve the above troubles, and efficient-ization of it by copper loss reduction is attained, without making the wire size of an armature winding thick. Moreover, since the 1st time and the 2nd number of winding are changeable, an input can be tuned finely. Furthermore, it is stabilized, the conductor spacing in the hook of a commutator can be secured, and poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. are aimed at offering a commutator motor which solves the trouble on quality.

[0012]

[Means for Solving the Problem] About the coil approach of the armature winding of the commutator motor of claim 1 this invention, by the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number An armature coil makes respectively sequential connection of the armature winding to which the coil of the start of a volume was carried out once [at least] to a pair each of slots

which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. A coil is carried out one by one to the $N/2$ nd opposite slots. After the $N/2$ nd coils for a slot each armature winding -- and a coil is further carried out one by one to the $N/2$ nd opposite slots, and a coil is carried out and it is formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the $N+1$ st commutator segments, respectively.

[0013] By thus, the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number By coiling a coil about over the slot perimeter (duplex as a result) of an armature core, one armature winding to which the coil of the start of a volume was carried out to a pair each of slots of the armature core which is in the position of symmetry, respectively Since the coil of the two armature windings is carried out to the slot semicircle of an armature core and it becomes the same thing as winding ***** about an armature winding one-fold, For example, since the cross section equivalent to what coils an armature winding around one-fold about can be obtained by winding ***** when the wire size of an armature winding is $\phi 0.65\text{mm}$ about an armature winding at a duplex when the wire size of an armature winding is $\phi 0.45\text{mm}$ A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained. Moreover, since it becomes possible if the wire size of an armature winding is less than [$\phi 0.45\text{mm}$] for it to be stabilized and to be able to secure the conductor spacing of the commutator hook section, since it is a thin line, for poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. to be able to solve the trouble on quality, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction.

[0014] the commutator motor of claim 2 of this invention -- an armature -- all -- a conductor -- it sets up so that the ratio of a number and the number of field windings may be set to more than 6:1. The spark depressor effect by transformer operation of an armature winding is improvable by making it the ratio of such a number of coils. Thus, the number of turns of an armature winding are made [many], and it becomes possible by decreasing the iron loss and copper loss of a field to make a life 1.2 times as long as before by the improvement in effectiveness, and rectification improvement.

[0015] About the commutator motor of claim 3 of this invention, the phase angle of the core of an armature winding and the core of the field pole is set up so that it may come among 10 degrees - 30 degrees. Thus, while there is little spark generating and it can control a black bar phenomenon by arranging according to the spark depressor effect by transformer operation with the next armature core slot inner lining line of a hand of cut, improvement in the life of a brush can be aimed at.

[0016] By the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core about the armature winding of the commutator motor of claim 4 of this invention An armature coil makes respectively sequential connection of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots which have the start of a volume in the position of symmetry, respectively, respectively continuously to the next commutator segment. To the $N/2$ nd opposite slots, carry out a coil one by one and a coil is carried out one by one to the $N/2$ nd opposite slots. after the $N/2$ nd coils for a slot -- each armature winding -- and a coil is further carried out one by one to the $N/2$ nd opposite slots, and a coil is carried out and it is formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the $N+1$ st commutator segments, respectively.

[0017] By thus, the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core By coiling a coil about over the slot perimeter (it being an integral multiple pile to the number of slots as a result) of an armature core, one armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which has the start of a volume in the position of symmetry, respectively Since the number of slots serves as a 1-/integral multiple of the number of commutator segments and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, An engine-performance improvement effect and the effectiveness by the productivity drive can be acquired like the 1 slot-1 segment method stated by claim 1.

[0018] About the armature winding of the commutator motor of claim 5 of this invention, by the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number An armature

coil makes respectively sequential connection of the armature winding by which the coil of the start of a volume was carried out once [at least] to 2 juxtaposition by carrying out to the number of a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. A coil is carried out one by one to the $N/2$ nd opposite slots, and a coil is carried out and it is formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to $N / \text{the } 2+1\text{st commutator segments, respectively.}$

[0019] By thus, the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number By carrying out the coil of the armature winding made 2 juxtaposition to which the coil of the start of a volume was carried out to a pair each of slots of the armature core which is in the position of symmetry, respectively over the slot semicircle of an armature core An engine-performance improvement effect and the effectiveness by the productivity drive can be substantially acquired like the 1 slot-1 segment method which stated one armature winding by claim 1 since it became the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core.

[0020] By the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core about the armature winding of the commutator motor of claim 6 of this invention An armature coil makes respectively sequential connection of the armature winding to which the coil only of the number was carried out to the number of slots to the number of a pair each of slots which have the start of a volume in the opposite position of symmetry, respectively in two or more lines of the same number as the commutator segment of an integral multiple, respectively continuously to the next commutator segment. A coil is carried out one by one to the $N/2$ nd opposite slots, and a coil is carried out and it is formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to $N / \text{the } 2+1\text{st commutator segments, respectively.}$

[0021] By thus, the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core By coiling a coil about over the slot perimeter (it being an integral multiple pile to the number of slots as a result) of an armature core, two armature windings to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which has the start of a volume in the position of symmetry, respectively Since the number of slots serves as a 1-/integral multiple of the number of commutator segments and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, An engine-performance improvement effect and the effectiveness by the productivity drive can be acquired like the 1 slot-1 segment method stated by claim 1.

[0022] About the armature winding of the commutator motor of claim 7 of this invention, by the 1 slot-1 segment method which equipped the commutator with the armature core slot of N individual, and the commutator segment of the same number An armature coil makes respectively sequential connection of the armature winding to which the coil of the start of a volume was carried out once [at least] to a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. Carry out a coil one by one to the $N/2$ nd opposite slots, and it once cuts after the $N/2$ nd coils for a slot. It starts from the place which carried out [predetermined *****] the volume start of each armature winding from it, and a coil is carried out and it is formed so that a coil may be carried out one by one from the location which was able to be shifted to the $N/2$ nd opposite slots, it may count from the start of a volume and the terminal of an armature winding may be connected to $N / \text{the } 2+1\text{st commutator segments, respectively.}$

[0023] By thus, the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number In case the start of a volume carries out the coil of the one armature winding by which the coil was carried out to a pair each of slots of the armature core which is in the position of symmetry, respectively over the semicircle [every] perimeter of the slot of an armature core mutually The volume start of the remaining semicircle start from the place predetermined ***** carried out, and and by carrying out a coil one by one from the location which was able to be shifted to the $N/2$ nd opposite slots The same effectiveness as the method stated by claim 1 can be acquired, and the 1st time and the 2nd coil balance within one more slot become good, can reduce the initial imbalance of an armature 30%, and leads to an improvement of armature balance correction.

[0024] It sets up so that number of turns may become the 1st time > the 2nd time by the 1 slot-1 segment method which equipped the commutator with the armature core slot of N individual, and the commutator segment of the same number as the 1st time and the 2nd wirewound resistor become almost the same by the armature winding within the slot of a pair, and that ratio may be set to 1.1-1.4 about the armature winding of the commutator motor of

claim 8 of this invention.

[0025] By thus, the 1 slot-1 segment method which equipped the commutator with the armature core slot of N individual, and the commutator segment of the same number. When the 1st time and the 2nd number of turns become the 1st time > the 2nd time by the armature winding within the slot of a pair and it is made for the ratio to be set to 1.1-1.4. The same effectiveness as the method stated by claim 1 can be acquired, and since the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, an improvement of a life is also expectable. Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before, it is being able to extend the width of 1x8.5T, 1x9.5T, and a coil specification by changing the 1st time and the 2nd number-of-turns specification, and in case input adjustment is performed by the coil specification, compared with the former, it becomes very advantageous.

[0026] By the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core about the armature winding of the commutator motor of claim 9 of this invention. Make respectively sequential connection of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out [as opposed to / respectively / the number of slots] to a pair each to which an armature coil has the start of a volume in the position of symmetry, respectively as for an armature coil of slots continuously to the next commutator segment, and a coil is carried out one by one to the N/2nd opposite slot. Once cut after the N/2nd coils for a slot, and it starts from the place which carried out [predetermined *****] the volume start of each armature winding from it. A coil is carried out one by one from the location which was able to be shifted to the N/2nd opposite slots, and a coil is carried out and it is formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

[0027] By thus, the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core. In case the start of a volume carries out the coil of the one armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which is in the position of symmetry, respectively over the semicircle [every] perimeter of the slot of an armature core mutually. The volume start of the remaining semicircle start from the place predetermined ***** carried out, and and by carrying out a coil one by one from the location which was able to be shifted to the N/2nd opposite slots. The same effectiveness as the method stated by claim 1 can be acquired, and the 1st time and the 2nd coil balance within one more slot become good, can reduce the initial imbalance of an armature 30%, and leads to an improvement of armature balance correction.

[0028] By the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core about the armature winding of the commutator motor of claim 10 of this invention. By the 1 slot-1 segment method which equipped the commutator with the armature core slot of N individual, and the commutator segment of the same number, it sets up so that number of turns may become the 1st time > the 2nd time as the 1st time and the 2nd wirewound resistor become almost the same by the armature winding within the slot of a pair, and the ratio may be set to 1.1-1.4.

[0029] By thus, the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core. When the 1st time and the 2nd number of turns become the 1st time > the 2nd time by the armature winding within the slot of a pair and it is made for the ratio to be set to 1.1-1.4. The same effectiveness as the method stated by claim 1 can be acquired, and since the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, an improvement of a life is also expectable. Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before, it is being able to extend the width of 1x8.5T, 1x9.5T, and a coil specification by changing the 1st time and the 2nd number-of-turns specification, and in case input adjustment is performed by the coil specification, compared with the former, it becomes very advantageous.

[0030]

[Embodiment of the Invention]

One or less gestalt of implementation of invention and the gestalt 1 of implementation of this invention are explained about drawing. The coil schematics of a commutator motor with which drawing 1 expresses the gestalt 1 of implementation of this invention, and drawing 2 are [a commutator connection side elevation and drawing 4 of

the armature commutator section plan of a commutator motor and drawing 3] the commutator connection section partial enlarged drawings of a commutator motor. In drawing, 1 expresses an armature core slot and 1-1--1-22 expresses the slot number. Into the armature winding and said armature core slot 1, it was equipped with the armature winding one by one, and 2 illustrated an armature winding 2-1 and 2-2 to drawing 1 . 3 expresses a commutator segment and 3-1--3-22 expresses the number of a commutator segment. Organic solvents, such as a hook a commutator and whose 6 4 is the commutator connection sections as for a carbon brush and 5, a wedge whose 7 is an armature core and an insulating member held so that an armature core slot insulation member may not jump out of an armature core end-face insulating member and 9 with a centrifugal force and an armature winding may not jump out [slot / armature core] from 8 of 10, and a varnish with which 11 carries out insulating fixing of the armature winding, and 12 are revolving shafts.

[0031] Next, the coil gestalt of an armature coil is explained. As shown in drawing 4 from drawing 1 , the number of commutator segments 3 is the case (this is called "1 slot-1 segment method") where the number of 22 and the armature core slots 1 is 22. With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. The start of a volume connects with a commutator segment 3-1, and is looped around in a slot 1-1 and 1 -10, and a volume end connects an armature winding 2-1 to a commutator segment 3-2. The start of a volume connects with a commutator segment 3-12, and is looped around in a slot 1-12 and 1 -21, and a volume end connects another armature winding 2-2 to a commutator segment 3-13.

[0032] Hereafter, it loops around over the semicircle of the armature core slot 1 similarly, and a volume end is looped around in a slot 1-12 and 1 -21 by not cutting in the terminal after a commutator segment 3-12 and the volume end of an armature winding 2-2 connecting with a commutator segment 3-1, and a volume end connects each armature winding 2-1 to a commutator segment 3-13 for an armature winding 2-1. Moreover, an armature winding 2-2 is looped around in a slot 1-1 and 1 -10, and a volume end connects it to a commutator segment 3-2. Thus, the pan of the armature core slot 1 is looped around over a semicircle further once again, and the final volume end of an armature winding 2-1 is connected to a commutator segment 3-1, and the final volume end of an armature winding 2-2 is connected to a commutator segment 3-12, and it is cut. In drawing, P shows the hand of cut of an armature winding 2. Moreover, the illustration location of a carbon brush 4 corresponds, just before the armature winding 2 which constitutes an armature winding 2 completes rectification.

[0033] By thus, the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number By coiling a coil about over the perimeter (duplex as a result) of the armature core slot 1, one armature winding 2 to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively Since it becomes carrying out the coil of the two armature windings 2 to the semicircle of the armature core slot 1, and coiling an armature winding 2 around one-fold about, and the same thing, for example, an armature winding 2 by winding *****, since the cross section equivalent to ***** can be obtained to one-fold when the wire size of an armature winding 2 is $\phi 0.65\text{mm}$ about an armature winding 2 at a duplex when the wire size of an armature winding 2 is $\phi 0.45\text{mm}$ A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained.

[0034] Moreover, if the wire size of an armature winding 2 is less than [$\phi 0.45\text{mm}$], since it is a thin line, it is stabilized and the conductor spacing in the hook 6 of a commutator can be secured. Since it becomes possible [poor fusing, deformation of an open circuit and hook 6, coil processing degradation, etc. to hook 6] for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction.

[0035] The gestalt 2 of implementation of invention, next the gestalt 2 of implementation of this invention are explained about drawing. Drawing 5 is drawing which looked at the field core and the armature core from the top. Drawing 6 is the graph of the life of the rate of a turn ratio, and a carbon brush. Drawing 7 is the side elevation of a commutator motor. The gestalt 2 of implementation of this invention is the modification of the gestalt 1 of implementation of invention. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. As for a field core and 14, 13 is [a field winding and 19] commutator motors. it is shown in drawing 5 and drawing 6 -- as -- an armature winding 2 -- all -- a conductor -- the spark depressor effect by transformer operation of an armature winding 2 can be improved by setting up so that the ratio of a number and the number of field windings 14 may be set to more than 6:1, and spark generating becomes small. Thus, the number of turns of an armature winding 2 are

made [many], and it becomes possible by decreasing the iron loss and copper loss of a field to make a life 1.2 times as long as before by the improvement in effectiveness, and rectification improvement.

[0036] an armature winding 2 -- all -- a conductor -- the ratio of a number and the number of field windings 14 -- more than 6: -- by setting up so that it may be set to 1 explains below why the improvement in effectiveness and a rectification improvement are achieved. Between the commutators which are a part of armatures which are body of revolution, the carbon brush performed current energization and has short-circuited it with the carbon brush in the generator or the motor. The operation which suppresses the short-circuit current which flows in case the current of an armature coil reverses the direction of current ejection 180 degrees electrically during a contact period is performed. For every rotation, this is a 2 times carbon brush, each coil of an armature short-circuits it, the current in a coil is because the direction is reversed from -1 to -1 next from +1 to -1 each time, the time amount starts the moment the armature coil short-circuited with the carbon brush, when a short circuit is canceled, it is finished, and it is a short time very much.

[0037] And if it becomes beyond the limit which there is delay of magnetic flux at the time of undercommutation, and is because it cannot finish negating the reactance voltage which changes with a current, and has the delay of magnetic flux, current change will become large at the time of termination of rectification, and it will become easy to generate a spark from the outlet of a brush. Moreover, at the time of an overcommutation, the progress condition of magnetic flux becomes quick undercommutation and reversely, and it lifting-comes to be easy of the same phenomenon. The condition of straight line commutation that a short-circuit current serves as current distribution proportional to the touch area of a carbon brush is opposite the most desirable. In order to make this condition, the inductance L of an armature winding and the relation between a commutating period T and the armature-winding resistance R The result of having checked R for it being satisfied with becoming $L < RT$ and performing this straight line commutation in the experiment, By enlarging armature-winding resistance R when winding so that the ratio of all RT several/conductor ST coils may become six or more, as shown in drawing 6 , and setting up a line specification, a rectification improvement can be performed and the improvement in effectiveness and a life can be lengthened.

[0038] The gestalt 3 of implementation of invention, next the gestalt 3 of implementation of this invention are explained about drawing. The schematics in which drawing 8 shows coil arrangement of the armature winding of a commutator motor, and drawing 9 are the graphs of gap of a phase angle and the life of a carbon brush. The gestalt 3 of implementation of this invention is the modification of the gestalt 1 of implementation of invention. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. 16 is the field pole. As shown in drawing 8 , the phase angle X of the core of an armature winding 2 and the core of the field pole 16 is set up so that it may come among 10 degrees - 30 degrees. Thus, while there is little spark generating and it can control a black bar phenomenon by arranging according to the spark depressor effect by transformer operation with the next slot inner lining line of a hand of cut, improvement in the life of a brush can be aimed at. In addition, drawing 9 shows the life property of the carbon brush in the commutator motor 21 of input 1300W by rated voltage 100V.

[0039] Here, the include angle alpha which neutral shaft X-Y with a geometric phase angle X and electrical-neutral-axis X'-Y' make is said here, and, generally the hand of cut and hard flow of an armature are made forward. Usually, the shaft of a field and a carbon brush fixes adjustment of this include angle alpha, and it is carried out by changing the connection include angle of the armature coil lead to a commutator. This connection include angle is usually adjusted at the press fit include angle of the commutator to an armature core slot. When it asks for this optimal phase angle experimentally, as it is shown in drawing 9 , since it comes to the location where the sense of the magnetic flux produced according to the flowing current can expect spark depressor effect according to a transformer operation of an armature winding by setting it as 10-30 degrees, spark generating becomes small, a rectification improvement can be performed, and the improvement in effectiveness and a life can be lengthened. Therefore, it is effective in shifting and setting up the press fit include angle of a commutator from the core of a field and an armature core slot.

[0040] The gestalt 4 of implementation of invention, next the gestalt 4 of implementation of this invention are explained about drawing. The coil schematics of a commutator motor with which drawing 10 expresses the gestalt of implementation of this invention, and drawing 11 are the commutator connection section partial enlarged drawings of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the coil gestalt of an armature coil is explained. As shown in drawing 10 and drawing 11 , the number of commutator segments 3 is the case (this is called "1 slot-2-N segment method") where the number of 24 and the armature core

slots 1 is 12. With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. It is looped around in a slot 1-1 and 1-6, the start of a volume connects with a commutator segment 3-1, and the end of a volume connects an armature winding 2-1 to a commutator segment 3-2. And it is again looped around in a slot 1-1 and 1-6, and the end of a volume is connected to the commutator segment 3-3 of the next door of a commutator segment 3-2. By such coil approach, a coil is performed along the direction of a coil in good order, and an armature coil is formed.

[0041] Similarly, it is looped around in a slot 1-7 and 1-12, the start of a volume connects with a commutator segment 3-13, and the end of a volume connects an armature winding 2-2 to a commutator segment 3-14. And it is again looped around in a slot 1-7 and 1-12, and the end of a volume is connected to the commutator segment 3-15 of the next door of a commutator segment 3-14. Hereafter, it loops around over a semicircle with 12 slots of the armature core slot 1 similarly, and the volume end of each armature winding 2-1 does not cut to 3-13 after the volume end of an armature winding 2-2 connecting with 3-1, but an armature winding 2-1 is looped around in a slot 1-7 and 1-12, and the end of a volume connects it to 3-14. An armature winding 2-2 is looped around in a slot 1-1 and 1-6, and the end of a volume connects it to a commutator segment 3-2.

[0042] Thus, the pan of the armature core slot 1 is looped around over a semicircle further once again, and the final volume end of an armature winding 2-1 is connected to a commutator segment 3-1, and the final volume end of an armature winding 2-2 is connected to a commutator segment 3-13, and it is cut. In drawing, P shows the hand of cut of armature Maki 2 line. Thus, since it becomes the same effectiveness as having carried out the coil of the armature winding 2 to juxtaposition by carrying out a double coil by one armature winding 2, for example, when the wire size of an armature winding 2 is $\phi 0.45\text{mm}$, the cross section equivalent to $\phi 0.65\text{mm}$ can be obtained by winding ***** to a duplex.

[0043] By thus, the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many commutator segment 3 as this to the number of the armature core slots 1 By coiling a coil about over the perimeter of the armature core slot 1, one armature winding 2 to which the coil only of the same number as the twice as many commutator segment 3 as this was carried out to the number of slots to a pair each of slots of the armature core 7 which has the start of a volume in the position of symmetry, respectively Since the number of slots becomes by 1/2 twice the number of commutator segments 3 and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, for example, an armature winding 2 by winding ***** , since the cross section equivalent to ***** can be obtained to one-fold when the wire size of an armature winding 2 is $\phi 0.65\text{mm}$ about an armature winding 2 at a duplex when the wire size of an armature winding 2 is $\phi 0.45\text{mm}$ A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained.

[0044] Moreover, if the wire size of an armature winding 2 is less than [$\phi 0.45\text{mm}$], since it is a thin line, it is stabilized and the conductor spacing in the hook 6 of a commutator can be secured. Since it becomes possible [poor fusing, deformation of an open circuit and hook 6, coil processing degradation, etc. to hook 6] for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction. In addition, with the gestalt 4 of implementation of this invention, although the number of commutator segments 3 described the case where the number of 24 and the armature core slots 1 was 12, in the case of the integral multiple of the number of the armature core slots 1, the number of commutator segments 3 will coil a coil about for one armature winding 2 to which the coil only of the same number as the commutator segment 3 of an integral multiple was carried out to the number of slots to a pair each of slots over the perimeter of the armature core slot 1.

[0045] The gestalt 5 of implementation of invention, next the gestalt 5 of implementation of this invention are explained about drawing. Drawing 12 is the coil schematics of the commutator motor showing the gestalt of implementation of this invention. Drawing 13 is the commutator connection section partial enlarged drawing of a commutator motor. Drawing 14 is the armature commutator section plan of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. 17 is an armature winding for parallel winding. Next, the coil gestalt of an armature coil is explained. As shown in drawing 12 and drawing 13 , the number of commutator segments 3 is the case (1 slot-1 segment method) where the number of 22 and the armature core slots 1 is 22. With a winding machine with two coil flyers, two armature windings 2-1 which have the start of a volume in the position of symmetry, respectively, 17-1 and two armature windings 2-2, and 17-2 are arranged in juxtaposition with one

coil flyer, and a coil is started to coincidence.

[0046] The start of a volume connects with a commutator segment 3-1, and is looped around in a slot 1-1 and 1 -10, and the end of a volume connects an armature winding 2-1 and 17-1 to a commutator segment 3-2. Moreover, the start of a volume connects with a commutator segment 3-12, and is looped around in a slot 1-12 and 1 -21, and the end of a volume connects an armature winding 2-2 and 17-2 to a commutator segment 3-13. Hereafter, it loops around over the semicircle of the armature core slot 1 similarly, and each armature winding 2-1 and the volume end of 17-1 carry out a coil so that 3-12, each armature winding 2-2, and the volume end of 17-2 may be connected to 3-1.

[0047] By thus, the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number By carrying out the coil of the armature winding 2 made 2 juxtaposition to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle of the armature core slot 1 Since it becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the perimeter of the armature core slot 1 about one armature winding 2 substantially, for example, an armature winding 2, since the cross section equivalent to ***** can be obtained to one-fold when the wire size of an armature winding 2 is $\phi 0.65\text{mm}$ by coiling an armature winding 2 around a duplex about when the wire size of an armature winding 2 is $\phi 0.45\text{mm}$ A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained.

[0048] Moreover, since it becomes possible if the wire size of an armature winding 2 is less than [$\phi 0.45$] for it to be stabilized and to be able to secure the conductor spacing in the hook 6 of a commutator, since it is a thin line, for poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. to hook 6 to be able to solve the trouble on quality, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction.

[0049] The gestalt 6 of implementation of invention, next the gestalt 6 of implementation of this invention are explained about drawing. Drawing 15 is the coil schematics of the commutator motor showing the gestalt of implementation of this invention. Drawing 16 is the commutator connection section partial enlarged drawing of a commutator motor. The same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the coil gestalt of an armature coil is explained. As shown in drawing 15 $R > 5$ and drawing 16, the number of commutator segments 3 is the case (1 slot-2-N segment method) where the number of 24 and the armature core slots 1 is 12. With a winding machine with two coil flyers, two armature windings 2-1 which have the start of a volume in the position of symmetry, respectively, 17-1 and two armature windings 2-2, and 17-2 are arranged in juxtaposition with one coil flyer, and a coil is started to coincidence.

[0050] It is looped around in a slot 1-1 and 1-6, the start of a volume connects with a commutator segment 3-1, and the end of a volume connects an armature winding 2-1 and 17-1 to a commutator segment 3-2. And it is again looped around in a slot 1-1 and 1-6, and the end of a volume is connected to the commutator segment 3-3 of the next door of a commutator segment 3-2. Thus, an armature winding 2-1 and 17-1 form an armature coil. Similarly, it is looped around in a slot 1-7 and 1 -12, the start of a volume connects with a commutator segment 3-13, and the end of a volume connects an armature winding 2-2 and 17-2 to a commutator segment 3-14. And it is again looped around in a slot 1-7 and 1 -12, and the end of a volume is connected to the commutator segment 3-15 of the next door of a commutator segment 3-14. Hereafter, it loops around over a semicircle with 12 slots of the armature core slot 1 similarly, and a coil is carried out so that each armature winding 2-1 and the volume end of 17-1 may be connected to 3-13 and the volume end of 2-2 and 17-2 may be connected to 3-1.

[0051] By thus, the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many commutator segment 3 as this to the number of the armature core slots 1 By coiling a coil about over the perimeter of the slot 1 of an armature core, two armature windings 2 to which the coil only of the same number as the twice as many commutator segment 3 as this was carried out to the number of slots to a pair each of slots of the armature core 7 which has the start of a volume in the position of symmetry, respectively Since the number of slots becomes by 1/2 twice the number of commutator segments 3 and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the perimeter of the armature core slot 1 about one armature winding 2 substantially, for example, an armature winding 2, since the cross section equivalent to ***** can be obtained to one-fold when the wire size of an armature winding 2 is $\phi 0.65\text{mm}$ by coiling an armature winding 2 around a duplex about when the wire size of an armature winding 2 is $\phi 0.45\text{mm}$ A thing equivalent to the effectiveness of

the copper loss improvement which coils a thick wire and is obtained can be obtained.

[0052] Moreover, if the wire size of an armature winding 2 is less than $[\phi 0.45\text{mm}]$, since it is a thin line, it is stabilized and the conductor spacing in the hook 6 of a commutator can be secured. Since it becomes possible [poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. to hook 6] for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction. In addition, with the gestalt 6 of implementation of this invention, although the number of commutator segments 3 described the case where the number of 24 and the armature core slots 1 was 12, when the number of commutator segments 3 is the integral multiple of the number of the armature core slots 1, a coil will be coiled about for the armature winding of the number to which the coil only of the same number as the commutator segment 3 of an integral multiple was carried out to the number of slots to a pair each of slots over the perimeter of the slot 1 of an armature core.

[0053] The gestalt 7 of implementation of this invention is explained to the 7th gestalt of implementation of invention about drawing. The commutator connection section partial enlarged drawing of a commutator motor and drawing 19 of the coil schematics of a commutator motor with which drawing 1717 expresses the gestalt of implementation of this invention, and drawing 18 are the armature commutator section plans of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the coil gestalt of an armature coil is explained. As shown in drawing 19 from drawing 17, the number of commutator segments 3 is the case (1 slot-1 segment method) where the number of 22 and the armature core slots 1 is 22.

[0054] With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. The start of a volume connects with a commutator segment 3-1, and is looped around in a slot 1-1 and 1 -10, and the end of a volume connects an armature winding 2-1 to a commutator segment 3-2. The start of a volume connects with a commutator segment 3-12, and is looped around in a slot 1-12 and 1 -21, and the end of a volume connects an armature winding 2-2 to a commutator segment 3-13. Hereafter, it loops around over the semicircle of the armature core slot 1 similarly, and the volume end of each armature winding 2-1 carries out end cutting after the volume end of 3-12 and 2-2 connecting with 3-1.

[0055] Next, a coil is started for an armature winding 2-1, 2-3 equivalent to 2-2, and 2-4 to coincidence like the 1st time from the place which counted from the cut place to the hand of cut, and shifted 2 segment location. The start of a volume connects with a commutator segment 3-3, and is looped around in a slot 1-3 and 1 -12, and the end of a volume connects an armature winding 2-3 to a commutator segment 3-4. The start of a volume connects with a commutator segment 3-14, and is looped around in a slot 1-14 and 1-1, and the end of a volume connects an armature winding 2-4 to a commutator segment 3-15. Hereafter, the pan of the armature core slot 1 is similarly looped around over a semicircle, the volume end of each armature winding 2-3 connects with 3-14, and the volume end of an armature winding 2-4 connects with 3-3.

[0056] By thus, the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number In case the start of a volume carries out the coil of the one armature winding 2 by which the coil was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually The volume start of the remaining semicircle start from the place predetermined ***** carried out, and and by carrying out a coil one by one from the location which was able to be shifted to the N/2nd opposite slots The same effectiveness as the method stated by claim 1 can be acquired, and the 1st time and the 2nd coil balance within one more slot become good, can reduce the initial imbalance of an armature 30%, and leads to an improvement of armature balance correction.

[0057] The gestalt 8 of implementation of invention, next the gestalt 8 of implementation of this invention are explained about drawing. Drawing 20 is the armature commutator section plan of the commutator motor showing the gestalt of implementation of this invention. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Although the volume start of the remaining semicircle used as the 2nd time was started with the gestalt 7 of implementation of invention from the place which shifted 2 segment location from it, the 2nd coil starting position is counted from the following commutator segment 3 with the gestalt 8 of implementation of this invention, and it is ***** from the commutator segment 3 of 60 degrees - 120 degree beyond. Since how to wind is the same as the gestalt 7 of implementation of invention, concrete explanation is omitted. The same effectiveness as the

method stated to the preceding clause by the coil approach of such an armature winding can be acquired, and in 90degree**alpha to a coil, for a ***** reason, the initial imbalance of an armature can be reduced about 30%, and the coil which is the 2nd time is led to an improvement of armature balance correction.

[0058] The gestalt 9 of implementation of invention, next the gestalt 9 of implementation of this invention are explained about drawing. It is the cutting enlarged drawing of the armature core slot section with which, as for the graph of the rate of a turn ratio, and a life with which drawing 21 expresses the gestalt of implementation of this invention, and drawing 22, the graph of an input was considered as the number-of-turns specification, and, as for drawing 23, the coil of the armature winding was carried out. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. The gestalt 9 of implementation of this invention is the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number like the gestalten 1 and 7 of implementation of invention. Carry out the coil of the one armature winding 2 to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually. (That is, one armature winding carries out a duplex volume to a pair each of slots) It is set as a case so that number of turns may become the 1st time > the 2nd time as the 1st time and the 2nd wirewound resistor become almost the same with the coil within an opposite slot, and the ratio may be set to 1.1-1.4.

[0059] Thus, since the same effectiveness as the method stated by claim 1 by setting up can be acquired, the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, an improvement of a life is also expectable as shown in drawing 22. Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before By the ability of the width of 1x8.5T, 1x9.5T, and a coil specification to be extended by changing the 1st time and the 2nd number-of-turns specification as shown in drawing 23, in case an input is adjusted by the coil specification, compared with the former, it becomes very advantageous.

[0060] The gestalt 10 of implementation of invention, next the gestalt 10 of implementation of this invention are explained. The coil schematics of a commutator motor with which drawing 2424 expresses the gestalt of implementation of this invention, and drawing 25 are the rectification meridian section partial enlarged drawings of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the coil gestalt of an armature coil is explained. As shown in drawing 24 and drawing 25, the number of commutator segments 3 is the case (1 slot-2-N segment method) where the number of 24 and the armature core slots 1 is 12.

[0061] With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. It is looped around in a slot 1-1 and 1-6, the start of a volume connects with a commutator segment 3-1, and the end of a volume connects an armature winding 2-1 to a commutator segment 3-2. And it is again looped around in a slot 1-1 and 1-6, and the end of a volume is connected to the commutator segment 3-3 of the next door of a commutator segment 3-2. By such coil approach, a coil is performed along the direction of a coil in good order, and an armature coil is formed. Similarly, it is looped around in a slot 1-7 and 1-12, the start of a volume connects with a commutator segment 3-13, and the end of a volume connects an armature winding 2-2 to a commutator segment 3-14. And it is again looped around in a slot 1-7 and 1-12, and the end of a volume is connected to the commutator segment 3-15 of the next door of a commutator segment 3-14. Hereafter, it loops around over a semicircle with 12 slots of the armature core slot 1 similarly, and the volume end of each armature winding 2-1 once cuts to 3-13 after the volume end of 2-2 connecting with 3-1.

[0062] Next, winding is started for an armature winding 2-1 and 2-2 to coincidence like the 1st time from the place which counted to the hand of cut and shifted 2 segment location from the cut place. An armature winding 2-1 is looped around in a slot 1-7 and 1-12, and the end of a volume connects it to 3-14. An armature winding 2-2 is looped around in a slot 1-1 and 1-6, and the end of a volume connects it to a commutator segment 3-2. Thus, a pan with 12 slots of the armature core slot 1 is looped around over a semicircle further once again, and the final volume end of an armature winding 2-1 is connected to a commutator segment 3-1, and the final volume end of an armature winding 2-2 is connected to a commutator segment 3-13, and it is cut.

[0063] By thus, the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many commutator segment 3 as this to the number of the armature core slots 1 In case the start of a volume carries out the coil of the one armature winding 2 to which the coil only of the same number as the twice as many commutator

segment 3 as this was carried out to the number of slots to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually. The volume start of the remaining semicircle start from the place which shifted 2 segment location, and and by carrying out a coil one by one from the location which was able to be shifted to the N/2nd opposite slots. The same effectiveness as the method stated by claim 1 can be acquired, and the 1st time and the 2nd coil balance within one more slot become good, can reduce the initial imbalance of an armature 30%, and leads to an improvement of armature balance correction.

[0064] The gestalt 11 of implementation of invention, next the gestalt 11 of implementation of this invention are explained about drawing. Although the volume start of the remaining semicircle used as the 2nd time was started with the gestalt 10 of implementation of invention from the place which shifted 2 segment location from it, the 2nd coil starting position is counted from the following commutator segment 3 with the gestalt 11 of implementation of this invention, and it is ***** from the commutator segment 3 of 60 degrees - 120 degree beyond. Since how to wind is the same as the gestalt 10 of implementation of invention, concrete explanation is omitted. The same effectiveness as the method stated to the preceding clause by the coil approach of such an armature winding can be acquired, and in 90degree**alpha to a coil, for a ***** reason, the initial imbalance of an armature can be reduced about 30%, and the coil which is the 2nd time is led to an improvement of armature balance correction. Furthermore, since a coil configuration and a wirewound resistor become uniform and can improve rectification balance, an improvement of a life is also expectable.

[0065] the gestalt 12 of implementation of invention -- the gestalt 12 of implementation of this invention. Like the gestalten 4 and 10 of implementation of invention by the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many commutator segment 3 as this to the number of the armature core slots 1. Carry out the coil of the one armature winding 2 to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually. (That is, one armature winding carries out a duplex volume to a pair each of slots.) It is set as a case so that number of turns may become the 1st time > the 2nd time as the 1st time and the 2nd wirewound resistor become almost the same with the coil within an opposite slot, and the ratio may be set to 1.1-1.4.

[0066] Thus, since the same effectiveness as the method stated by claim 1 by setting up can be acquired, the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, an improvement of a life is also expectable as shown in drawing 22. Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before, it is being able to extend the width of 1x8.5T, 1x9.5T, and a coil specification by changing the 1st time and the 2nd number-of-turns specification, and in case an input is adjusted by the coil specification, compared with the former, it becomes very advantageous. Although all explained the commutator of alpha-hook method with the gestalt of implementation of invention mentioned above, it cannot be overemphasized that it is applicable about the commutator of a SUTAFINGU method (method which drives the connection of an armature winding into the slot in which it was prepared on the commutator, and is fixed).

[0067]

[Effect of the Invention] As mentioned above, it sets to the commutator motor of claim 1 of this invention. By the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number. By coiling a coil about over the slot perimeter (duplex as a result) of an armature core, one armature winding to which the coil of the start of a volume was carried out to a pair each of slots of the armature core which is in the position of symmetry, respectively. Since the coil of the two armature windings is carried out to the slot semicircle of an armature core and it becomes the same thing as winding ***** about an armature winding one-fold, for example, an armature winding by winding ***** , since the cross section equivalent to ***** can be obtained to one-fold when the wire size of an armature winding is $\phi 0.65\text{mm}$ about an armature winding at a duplex when the wire size of an armature winding is $\phi 0.45\text{mm}$. The effectiveness that a thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained is done so. Moreover, if the wire size of an armature winding is less than [$\phi 0.45\text{mm}$], since it is a thin line, it is stabilized and the conductor spacing of the commutator hook section can be secured. Since it becomes possible for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. the fault on manufacture is improvable -- in addition -- and it becomes unnecessary to inspect the conductor

spacing after connection visually, and the effectiveness of also becoming a productivity drive by man day reduction is done so.

[0068] the commutator motor of claim 2 of this invention -- setting -- an armature -- all -- a conductor -- since the spark depressor effect by transformer operation of an armature winding be improvable by setting up so that the ratio of a number and the number of field windings may be set to more than 6:1, the number of turns of an armature winding be make [many], it be decreasing the iron loss and the copper loss of a field, and the effectiveness it be ineffective to it being possible to make a life 1.2 times as long as before by the improvement in effectiveness and rectification improvement do so.

[0069] In the commutator motor of claim 3 of this invention, by setting up the phase angle of the core of an armature winding, and the core of the field pole so that it may come among 10 degrees - 30 degrees, while there is little spark generating and it can control a black bar phenomenon according to the spark depressor effect by transformer operation with the next armature core slot inner lining line of a hand of cut, the effectiveness that improvement in a brush life can be aim at is do so.

[0070] In the commutator motor of claim 4 of this invention By the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core By coiling a coil about over the slot perimeter (it being an integral multiple pile to the number of slots as a result) of an armature core, one armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which has the start of a volume in the position of symmetry, respectively Since the number of slots serves as a 1-/integral multiple of the number of commutator segments and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, By the 1 slot-2-N segment method as well as the 1 slot-1 segment method stated by claim 1 for example, an armature winding by winding *****, since the cross section equivalent to ***** can be obtained to one-fold when the wire size of an armature winding is $\phi 0.65\text{mm}$ about an armature winding at a duplex when the wire size of an armature winding is $\phi 0.45\text{mm}$ The effectiveness that a thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained is done so. Moreover, if the wire size of an armature winding is less than [$\phi 0.45\text{mm}$], since it is a thin line, it is stabilized and the conductor spacing of the commutator hook section can be secured. Since it becomes possible for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. the fault on manufacture is improvable -- in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and the effectiveness of also becoming a productivity drive by man day reduction is done so.

[0071] In the commutator motor of claim 5 of this invention, by the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number By carrying out the coil of the armature winding made 2 juxtaposition to which the coil of the start of a volume was carried out to a pair each of slots of the armature core which is in the position of symmetry, respectively over the slot semicircle of an armature core An engine-performance improvement effect and the effectiveness by the productivity drive can be substantially acquired like the 1 slot-1 segment method which stated one armature winding by claim 1 since it became the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core.

[0072] In the commutator motor of claim 6 of this invention, by the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core By coiling a coil about over the slot perimeter (it being an integral multiple pile to the number of slots as a result) of an armature core, two armature windings to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which has the start of a volume in the position of symmetry, respectively Since the number of slots serves as a 1-/integral multiple of the number of commutator segments and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, An engine-performance improvement effect and the effectiveness by the productivity drive can be acquired like the 1 slot-1 segment method stated by claim 1.

[0073] In the commutator motor of claim 7 of this invention, by the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number In case the start of a volume carries out the coil of the one armature winding by which the coil was carried out to a pair each of slots of the armature core which

is in the position of symmetry, respectively over the semicircle [every] perimeter of the slot of an armature core mutually The volume start of one remaining semicircle start from the place predetermined ***** carried out, and and by carrying out a coil one by one from the location which was able to be shifted to the N/2nd opposite slots The same effectiveness as the method stated by claim 1 can be acquired, the 1st time and the 2nd coil balance within one more slot become good, the initial imbalance of an armature can be reduced 30%, and the effectiveness of leading to an improvement of armature balance correction is done so.

[0074] In the commutator motor of claim 8 of this invention, by the 1 slot-1 segment method which equipped the commutator with the armature core slot of N individual, and the commutator segment of the same number By setting up so that number of turns may become the 1st time > the 2nd time as the 1st time and the 2nd wirewound resistor become almost the same by the armature winding within the slot of a pair, and the ratio may be set to 1.1-1.4 The same effectiveness as the method stated by claim 1 can be acquired, and since the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, the effectiveness that an improvement of a life is also expectable is done so. Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before, it is being able to extend the width of 1x8.5T, 1x9.5T, and a coil specification by changing the 1st time and the 2nd number-of-turns specification, and in case input adjustment is performed by the coil specification, compared with the former, it becomes very advantageous.

[0075] In the commutator motor of claim 9 of this invention, by the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core In case the start of a volume carries out the coil of the one armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which is in the position of symmetry, respectively over the semicircle [every] perimeter of the slot of an armature core mutually The volume start of one remaining semicircle start from the place predetermined ***** carried out, and and by carrying out a coil one by one from the location which was able to be shifted to the N/2nd opposite slots The same effectiveness as the method stated by claim 1 can be acquired, the 1st time and the 2nd coil balance within one more slot become good, the initial imbalance of an armature can be reduced 30%, and the effectiveness of leading to an improvement of armature balance correction is done so.

[0076] In the commutator motor of claim 10 of this invention, by the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core By the 1 slot-1 segment method which equipped the commutator with the armature core slot of N individual, and the commutator segment of the same number By setting up so that number of turns may become the 1st time > the 2nd time as the 1st time and the 2nd wirewound resistor become almost the same by the armature winding within the slot of a pair, and the ratio may be set to 1.1-1.4 The same effectiveness as the method stated by claim 1 can be acquired, and since the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, the effectiveness that an improvement of a life is also expectable is done so. Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before, it is being able to extend the width of 1x8.5T, 1x9.5T, and a coil specification by changing the 1st time and the 2nd number-of-turns specification, and in case input adjustment is performed by the coil specification, compared with the former, it becomes very advantageous.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] They are the coil schematics of the commutator motor showing the gestalt 1 of implementation of this invention.

[Drawing 2] It is the armature commutator section plan of the commutator motor showing the gestalt 1 of implementation of this invention.

[Drawing 3] It is a commutator connection side elevation showing the gestalt 1 of implementation of this invention.

[Drawing 4] It is a commutator connection section partial enlarged drawing showing the gestalt 1 of implementation of this invention.

[Drawing 5] It is drawing which looked at the field core showing the gestalt 2 of implementation of this invention, and the armature core from the top.

[Drawing 6] It is the graph of the life of the rate of a turn ratio and carbon brush showing the gestalt 2 of implementation of this invention.

[Drawing 7] It is the side elevation of the commutator motor showing the gestalt 2 of implementation of this invention.

[Drawing 8] They are the schematics showing coil arrangement of the armature winding showing the gestalt 3 of implementation of this invention.

[Drawing 9] It is the gap of a phase angle and the graph of the life of a brush showing the gestalt 3 of implementation of this invention.

[Drawing 10] They are the coil schematics of the commutator motor showing the gestalt 4 of implementation of this invention.

[Drawing 11] It is a commutator connection section partial enlarged drawing showing the gestalt 4 of implementation of this invention.

[Drawing 12] They are the coil schematics of the commutator motor showing the gestalt 5 of implementation of this invention.

[Drawing 13] It is a commutator connection section partial enlarged drawing showing the gestalt 5 of implementation of this invention.

[Drawing 14] It is an armature commutator section plan showing the gestalt 5 of implementation of this invention.

[Drawing 15] They are the coil schematics of the commutator motor showing the gestalt 6 of implementation of this invention.

[Drawing 16] It is a commutator connection section partial enlarged drawing showing the gestalt 6 of implementation of this invention.

[Drawing 17] They are the coil schematics of the commutator motor showing the gestalt 7 of implementation of this invention.

[Drawing 18] It is a commutator connection section partial enlarged drawing showing the gestalt 7 of implementation of this invention.

[Drawing 19] It is an armature commutator section plan showing the gestalt 7 of implementation of this invention.

[Drawing 20] It is an armature commutator section plan showing the gestalt 8 of implementation of this invention.

[Drawing 21] It is the graph showing the gestalt 9 of implementation of this invention of the rate of a turn ratio, and a life.

[Drawing 22] It is the graph of the number-of-turns specification showing the gestalt 9 of implementation of this invention, and an input.

[Drawing 23] The armature winding showing the gestalt 9 of implementation of this invention is the cutting enlarged drawing of the armature core slot section by which the coil was carried out.

[Drawing 24] They are the coil schematics of the commutator motor showing the gestalt 10 of implementation of this invention.

[Drawing 25] It is a commutator connection section partial enlarged drawing showing the gestalt 10 of implementation of this invention. It is a TO cutting plane Fig.

[Drawing 26] They are the coil schematics of the conventional commutator motor.

[Drawing 27] It is the armature side elevation of the conventional commutator motor.

[Drawing 28] It is the armature core slot cutting plane Fig. of the conventional commutator motor.

[Drawing 29] It is the commutator connection section partial enlarged drawing of the conventional commutator motor.

[Drawing 30] It is drawing which looked at a conventional field core and a conventional armature core from the top.

[Drawing 31] It is the armature commutator section plan of the conventional commutator motor.

[Drawing 32] It is the armature commutator section side elevation of the conventional commutator motor.

[Drawing 33] It is the armature commutator section bottom view of the conventional commutator motor.

[Drawing 34] It is the partial enlarged drawing of drawing 33 .

[Drawing 35] It is drawing of the coil injection section of a flyer winding machine which performs an armature winding.

[Description of Notations]

1 An armature core slot, 2 An armature winding, 3 A commutator segment, 5 A commutator, seven armature cores, 12 A revolving shaft, 13 A field core, 14 A field winding, 19 Commutator motor.

[Translation done.]

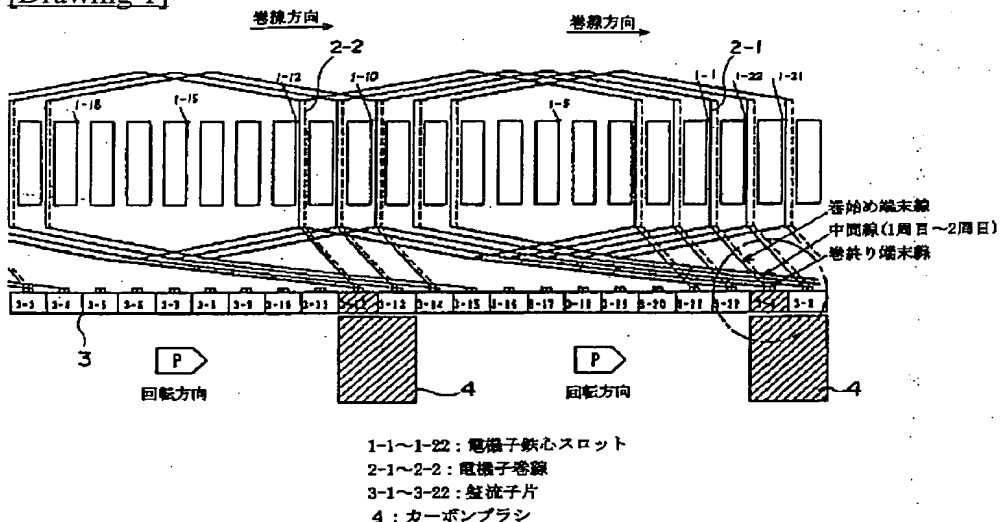
* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

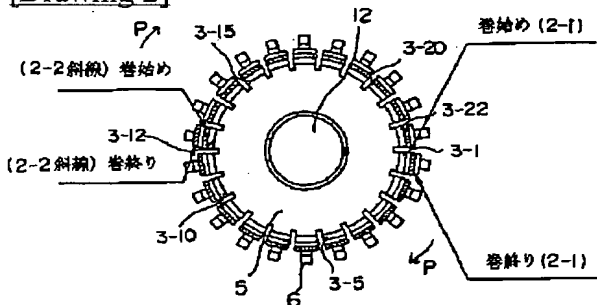
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

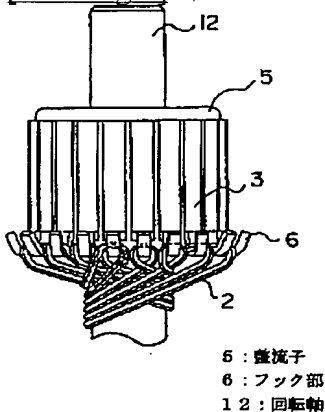
[Drawing 1]



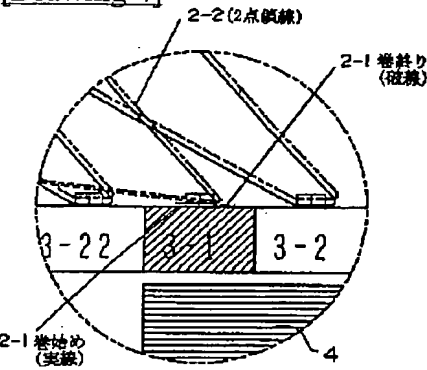
[Drawing 2]



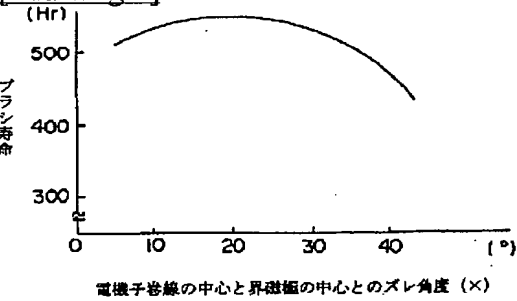
[Drawing 3]



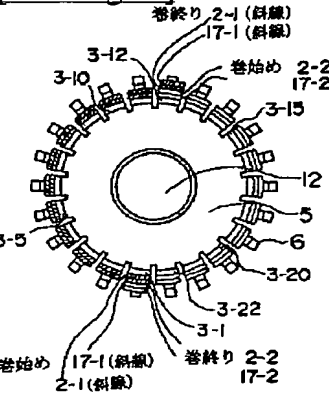
[Drawing 4]



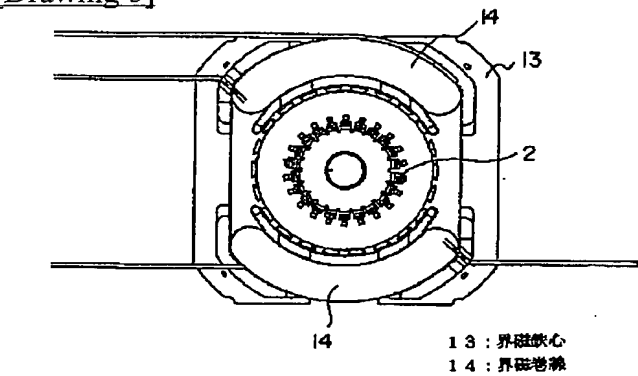
[Drawing 9]



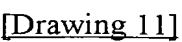
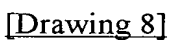
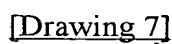
[Drawing 14]

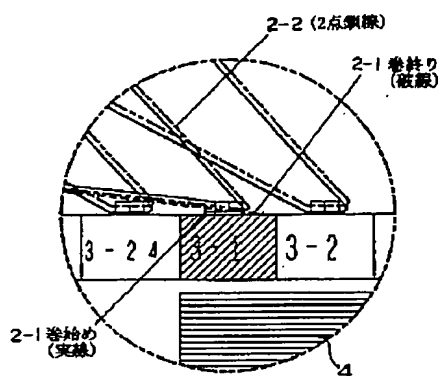


[Drawing 5]

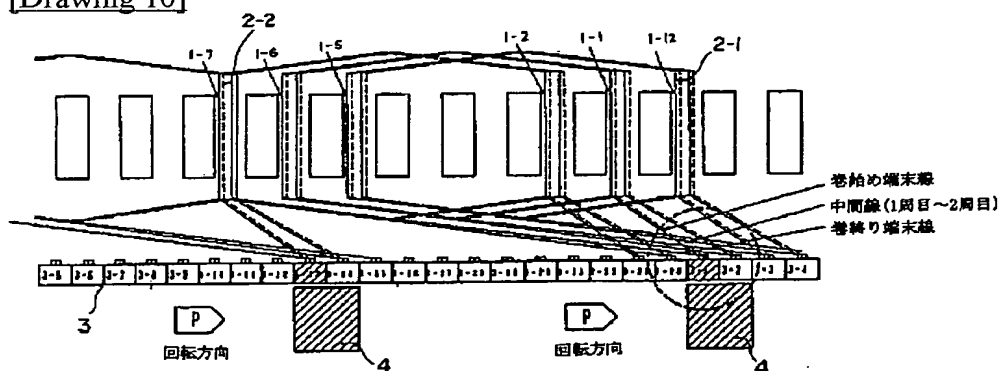


[Drawing 6]

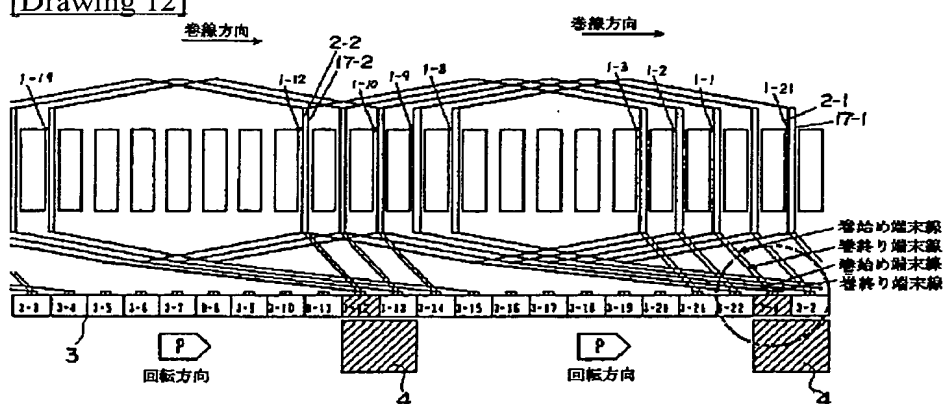




[Drawing 10]

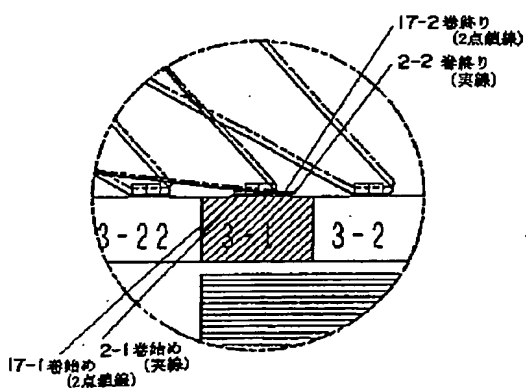


[Drawing 12]

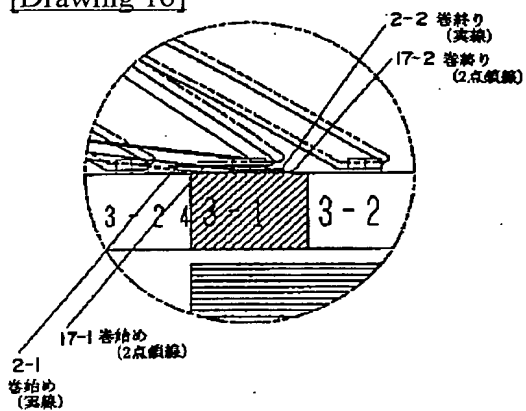


17-1~17-2: 電機子巻線 (並列用)

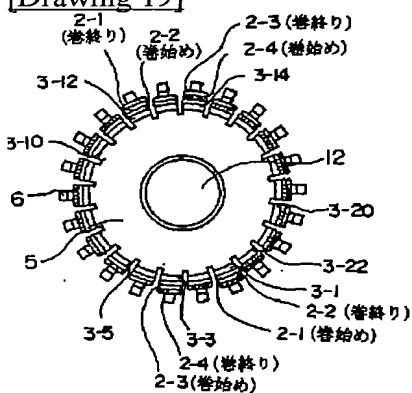
[Drawing 13]



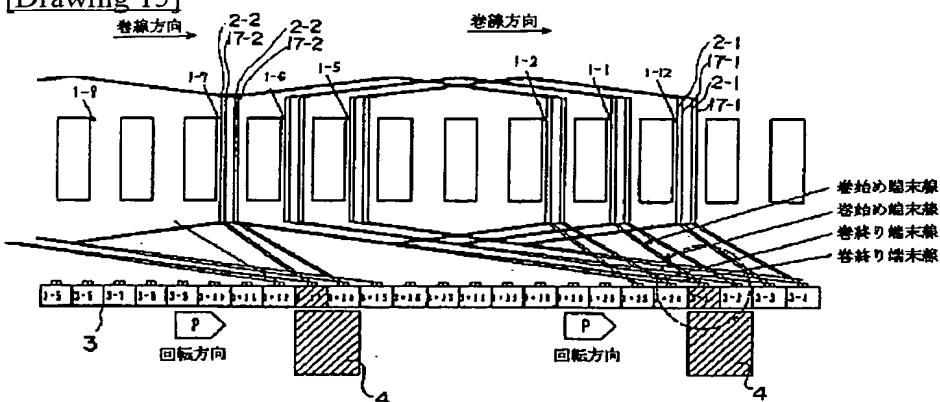
[Drawing 16]



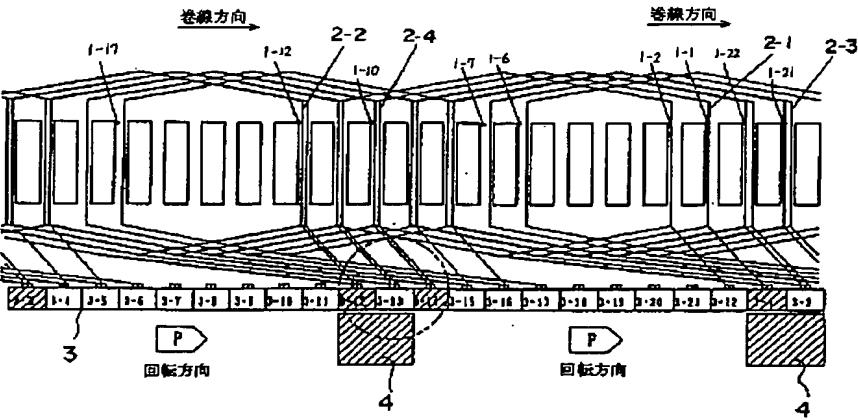
[Drawing 19]



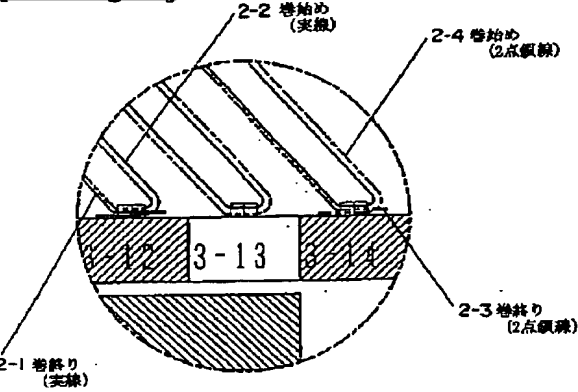
[Drawing 15]



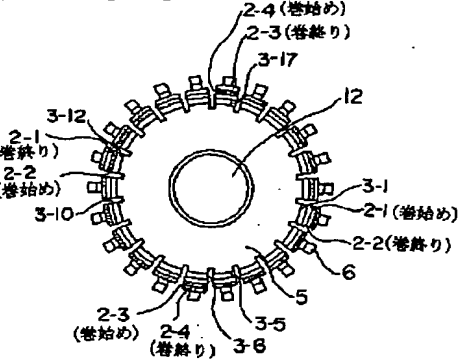
[Drawing 17]



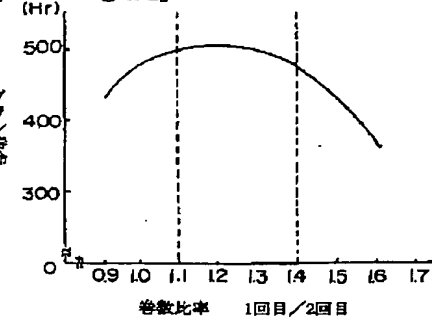
[Drawing 18]



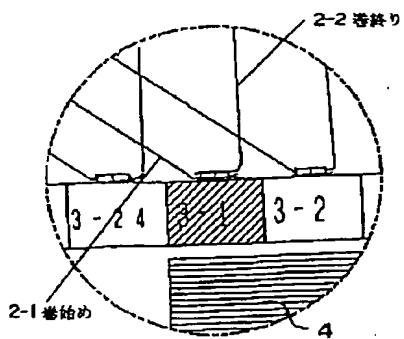
[Drawing 20]



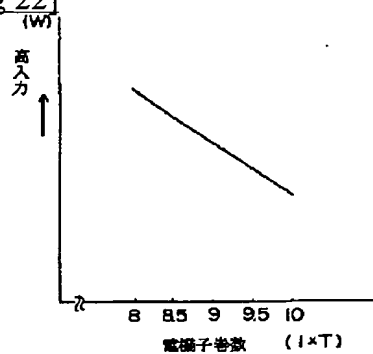
[Drawing 21]



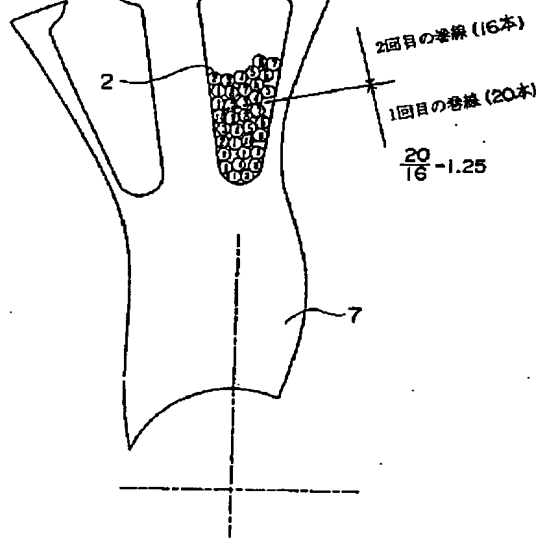
[Drawing 29]



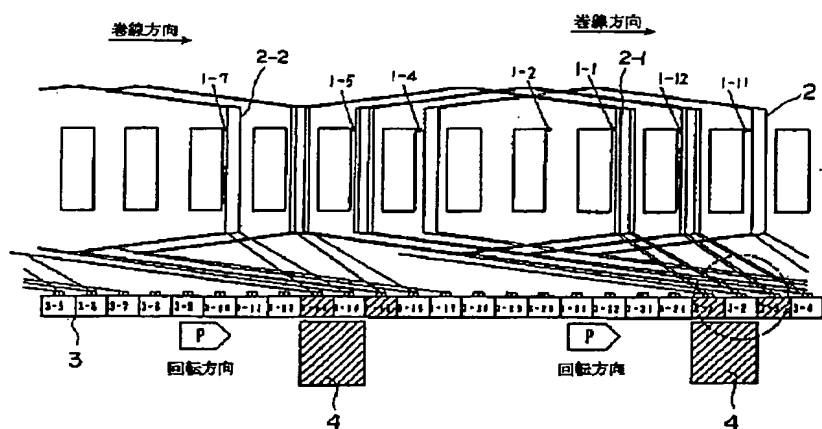
[Drawing 22]



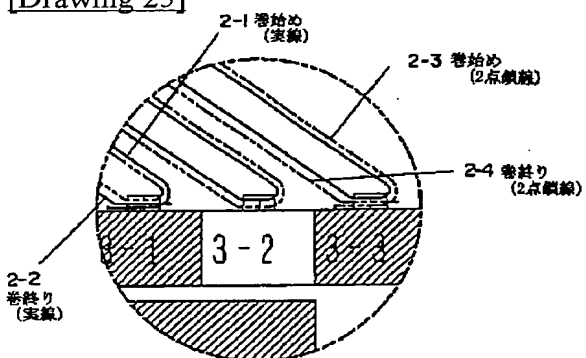
[Drawing 23]



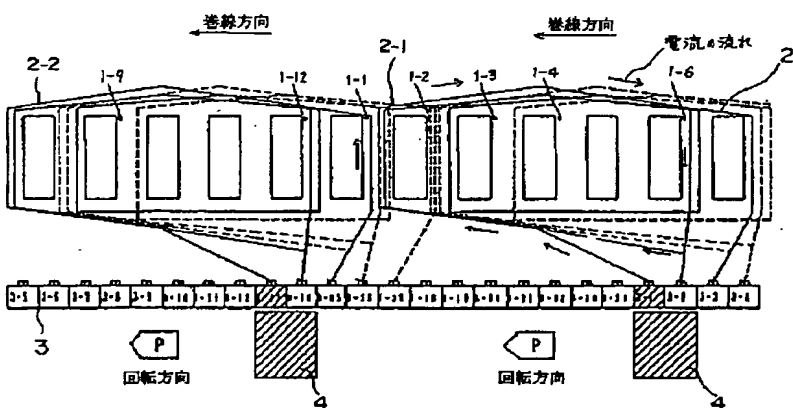
[Drawing 24]



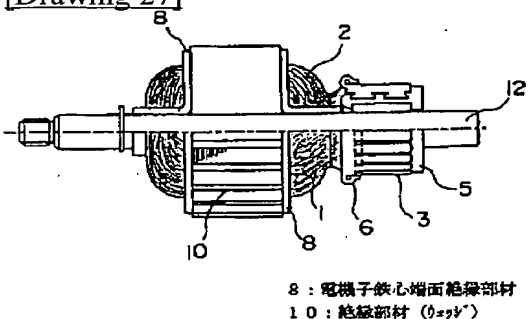
[Drawing 25]



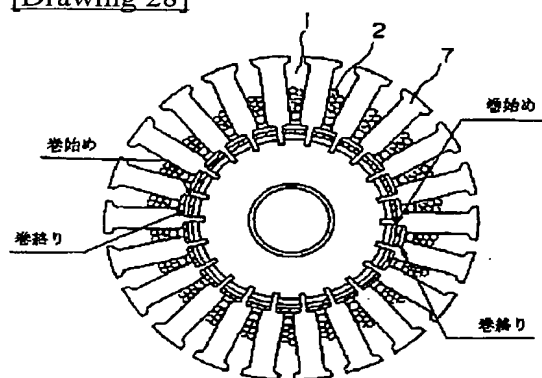
[Drawing 26]



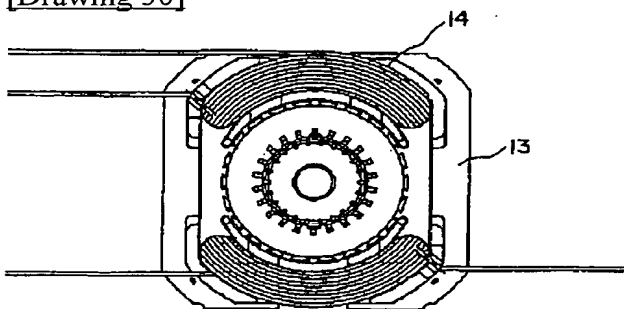
[Drawing 27]



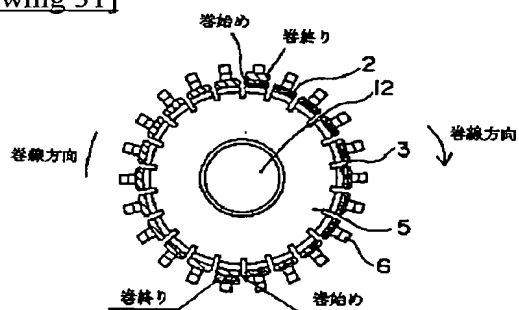
[Drawing 28]



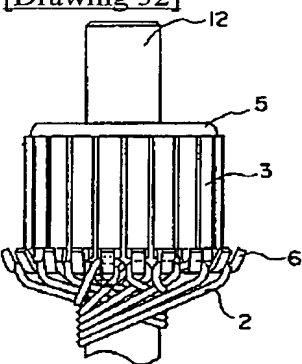
[Drawing 30]



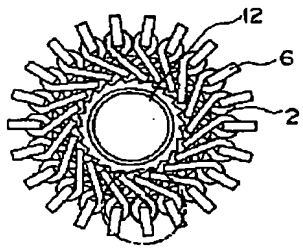
[Drawing 31]



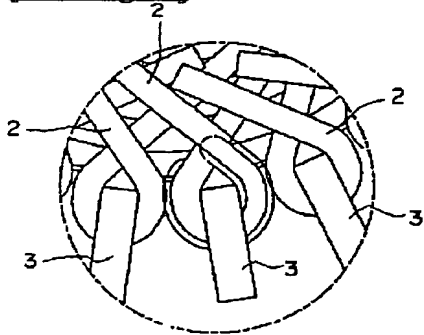
[Drawing 32]



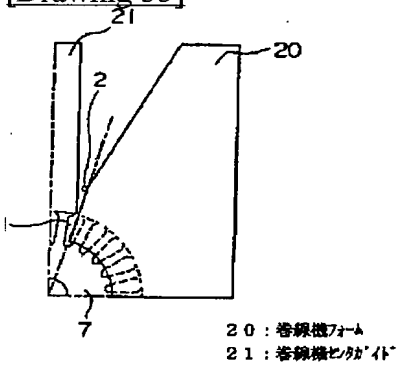
[Drawing 33]



[Drawing 34]



[Drawing 35]



[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
 [Section partition] The 4th partion of the 7th section
 [Publication date] January 18, Heisei 14 (2002. 1.18)

[Publication No.] JP,10-271788,A
 [Date of Publication] October 9, Heisei 10 (1998. 10.9)
 [Annual volume number] Open patent official report 10-2718
 [Application number] Japanese Patent Application No. 9-70168
 [The 7th edition of International Patent Classification]

H02K 23/26

[FI]

H02K 23/26

[Procedure revision]
 [Filing Date] July 30, Heisei 13 (2001. 7.30)
 [Procedure amendment 1]
 [Document to be Amended] Specification
 [Item(s) to be Amended] Claim
 [Method of Amendment] Modification
 [Proposed Amendment]
 [Claim(s)]

[Claim 1] In the commutator motor which consisted of armature coils formed by making sequential connection of the termination of the armature winding by which the coil was carried out at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment in the revolving shaft, the armature core with two or more slots of N connected to the revolving shaft, the commutator which is connected to a revolving shaft and has the slot of an armature core, and the commutator segment of the same number, and the slot of each set,

Said armature coil makes respectively sequential connection of the armature winding to which the coil of the start of a volume was carried out once [at least] to a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. A coil is carried out one by one to the N/2nd opposite slots. After the N/2nd coils for a slot each armature winding -- and the commutator motor which carries out a coil one by one to the N/2nd opposite slots further, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

[Claim 2] the above-mentioned commutator motor -- setting -- an armature -- all -- a conductor -- the commutator motor given in the 1st term of a claim characterized by setting up so that the ratio of a number and the number of field windings may become six or more.

[Claim 3] The commutator motor given in the 1st term of a claim characterized by setting up the phase angle of the core of said armature winding, and the core of the field pole in the above-mentioned commutator motor so that it may come among 10 degrees - 30 degrees.

[Claim 4] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment,

Said armature coil makes respectively sequential connection of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots which have the start of a volume in the position of symmetry, respectively, respectively continuously to the next commutator segment. To the N/2nd opposite slots, carry out a coil one by one and a coil is carried out one by one to the N/2nd opposite slots. after the N/2nd coils for a slot -- each armature winding -- and the commutator motor which carries out a coil one by one to the N/2nd opposite slots further, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

[Claim 5] In the commutator motor which consisted of armature coils formed by making sequential connection of the termination of the armature winding by which the coil was carried out at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment in the revolving shaft, the armature core with two or more slots of N individual connected to the revolving shaft, the commutator which is connected to a revolving shaft and has the slot of an armature core, and the commutator segment of the same number, and the slot of each set,

Said armature coil makes respectively sequential connection of the armature winding by which the coil of the start of a volume was carried out once [at least] to 2 juxtaposition by carrying out to the number of a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. The commutator motor which carries out a coil one by one to the N/2nd opposite slots, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to N / the 2+1st commutator segments, respectively.

[Claim 6] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the commutator segment of a twice [more than] as many integral multiple as this to the slot of an armature core, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment,

Said armature coil makes respectively sequential connection of the armature winding to which the coil only of the number was carried out to the number of slots to the number of a pair each of slots which have the start of a volume in the position of symmetry, respectively in two or more lines of the same number as the commutator segment of an integral multiple, respectively continuously to the next commutator segment. The commutator motor which carries out a coil one by one to the N/2nd opposite slots, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to N / the 2+1st commutator segments, respectively.

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] 0022

[Method of Amendment] Deletion

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0023

[Method of Amendment] Deletion

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0024

[Method of Amendment] Deletion

[Procedure amendment 5]

[Document to be Amended] Specification

[Item(s) to be Amended] 0025
[Method of Amendment] Deletion
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0026
[Method of Amendment] Deletion
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0027
[Method of Amendment] Deletion
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0028
[Method of Amendment] Deletion
[Procedure amendment 9]
[Document to be Amended] Specification
[Item(s) to be Amended] 0029
[Method of Amendment] Deletion
[Procedure amendment 10]
[Document to be Amended] Specification
[Item(s) to be Amended] 0073
[Method of Amendment] Deletion
[Procedure amendment 11]
[Document to be Amended] Specification
[Item(s) to be Amended] 0074
[Method of Amendment] Deletion
[Procedure amendment 12]
[Document to be Amended] Specification
[Item(s) to be Amended] 0075
[Method of Amendment] Deletion
[Procedure amendment 13]
[Document to be Amended] Specification
[Item(s) to be Amended] 0076
[Method of Amendment] Deletion

[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平10-271788

(43) 公開日 平成10年(1998)10月9日

(51) Int. Cl. ⁶
H02K 23/26

識別記号

F I
H02K 23/26

審査請求 未請求 請求項の数10 O L (全19頁)

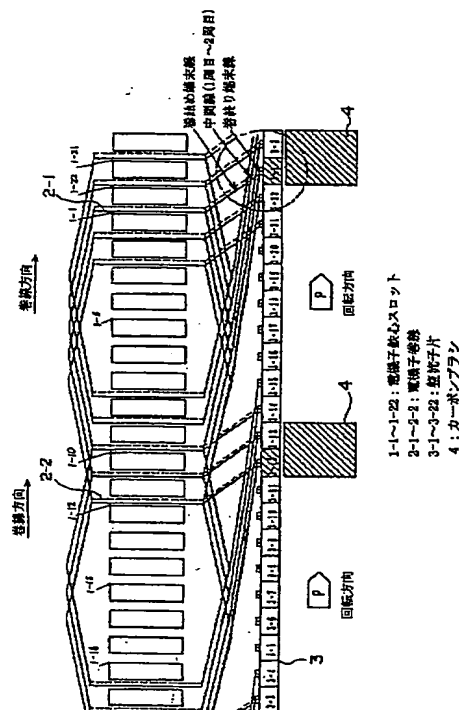
(21) 出願番号	特願平9-70168	(71) 出願人	000006013 三菱電機株式会社 東京都千代田区丸の内二丁目2番3号
(22) 出願日	平成9年(1997)3月24日	(71) 出願人	000176866 三菱電機ホーム機器株式会社 埼玉県大里郡花園町大字小前田1728番地1
		(72) 発明者	高橋 裕司 埼玉県大里郡花園町大字小前田1728番地1 三菱電機ホーム機器株式会社内
		(72) 発明者	尾高 秀一 埼玉県大里郡花園町大字小前田1728番地1 三菱電機ホーム機器株式会社内
		(74) 代理人	弁理士 佐々木 宗治 (外3名) 最終頁に続く

(54) 【発明の名称】 整流子電動機

(57) 【要約】

【課題】 電機子巻線の線径を太くすることなく銅損低減による高効率化が可能となり、整流子フック部の線間距離を安定して確保でき、ヒュージング不良や断線、フックの変形や巻線加工劣化等の品質上の問題点を解決すること。

【解決手段】 回転軸12と、回転軸12に接続された22個のスロット1を持つ電機子鉄心7と、回転軸12に接続され、電機子鉄心7のスロット1と同数の整流子片3を有する整流子5と、巻始めがそれぞれ対称位置にある電機子鉄心7の各一对のスロットに対してそれぞれ少なくとも1回巻線された電機子巻線2を各々の隣りの整流子片3に連続的に順次接続して、22/2個目の対スロット巻線後に、各々の電機子巻線2をそれから更に22/2個目の対スロットまで順次巻線し、巻始めてから数えて22+1個目の整流子片3に電機子巻線2の末端がそれぞれ接続されるよう巻線して形成される電機子コイルとで構成されている。



【特許請求の範囲】

【請求項1】 回転軸と、回転軸に接続された複数個Nのスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットと同数の整流子片を有する整流子と、各対のスロット内に巻線された電機子巻線の終端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、

前記電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットに対してそれぞれ少なくとも1回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に、各々の電機子巻線をそれから更に $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されていることを特徴とする整流子電動機。

【請求項2】 上記整流子電動機において、電機子全導体数と界磁巻線数との比率が6以上となるよう設定したことを特徴とする請求項第1項記載の整流子電動機。

【請求項3】 上記整流子電動機において、前記電機子巻線の中心と界磁極の中心との位相角度を $10^\circ \sim 30^\circ$ の間になるよう設定したことを特徴とする請求項第1項記載の整流子電動機。

【請求項4】 回転軸と、回転軸に接続された複数N個のスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットの数に対して2倍以上の整数倍の整流子片を有する整流子と、各対のスロット内にスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線の終端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、前記電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットに対してそれぞれスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に、各々の電機子巻線をそれから更に $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されていることを特徴とする整流子電動機。

【請求項5】 回転軸と、回転軸に接続された複数N個のスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットと同数の整流子片を有する整流子と、各対のスロット内に巻線された電機子巻線の終端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、

前記電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットの数に対してそれぞれ2本並列にして少なくとも1回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N/2+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されていることを特徴とする整流子電動機。

【請求項6】 回転軸と、回転軸に接続された複数N個のスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットに対して2倍以上の整数倍の整流子片を有する整流子と、各対のスロット内にスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線の終端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、前記電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットの数に対してそれぞれスロット数に対して整数倍の整流子片と同じ数の複数の線をその数だけ巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N/2+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されていることを特徴とする整流子電動機。

【請求項7】 回転軸と、回転軸に接続された複数N個のスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットと同数の整流子片を有する整流子と、各対のスロット内に巻線された電機子巻線の終端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、前記電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットに対してそれぞれ少なくとも1回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に一旦切断し、各々の電機子巻線の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置から $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N/2+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるよう巻線して形成されていることを特徴とする整流子電動機。

【請求項8】 上記整流子電動機において、一对のスロット内の電機子巻線で1回目と2回目の巻数が1回目 >2 回目であり、その巻線比率が $1.1 \sim 1.4$ であることを特徴とする請求項第1項又は請求項第7項記載の整流子電動機。

【請求項9】 回転軸と、回転軸に接続された複数N個のスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットの数に対して2倍以上の整数倍の整流子片を有する整流子と、各対のスロット内にスロット

数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線の末端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、前記電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットに対してそれぞれスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に一旦切断し、各々の電機子巻線の巻始めをそれから所定位置ずらしたところから開始し、ずらした位置から $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるよう巻線して形成されていることを特徴とする整流子電動機。

【請求項 10】 上記整流子電動機において、一对のスロット内の電機子巻線で 1 回目と 2 回目の巻数が 1 回目 > 2 回目であり、その巻線比率が 1.1 ~ 1.4 であることを特徴とする請求項第 4 項又は請求項第 9 項記載の整流子電動機。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 この発明は、電気掃除機及び電動工具等の回転機器に使用される整流子電動機に関するものである。

【0002】

【従来の技術】 近年の整流子電動機は、小型・高出力化の傾向を示し、それに使用される電機子に求められる性能課題もコア形状、コアグレード、板厚改善による鉄損低減や電機子巻線改善による銅損低減が求められており、特に電気掃除機に使用される整流子電動機は高効率を求めるための電機子巻線の太線化が進められている。

【0003】 図 26 は例えば、特公平 6-38704 号公報に示された従来の整流子電動機の巻線結線図、図 27 は従来の整流子電動機の電機子側面図、図 28 は従来の整流子電動機の電機子鉄心スロットの部分切断面の拡大図、図 29 は従来の整流子電動機の整流子結線部部分拡大図、図 30 は従来の界磁鉄心と電機子鉄心を上から見た図、図 31 は従来の整流子電動機の電機子整流子部上面図、図 32 は従来の整流子電動機の電機子整流子部側面図、図 33 は従来の整流子電動機の電機子整流子部下面図、図 34 は図 33 の部分拡大図、図 35 は電機子巻線を行うフライヤー巻線機の巻線投入部の図である。

【0004】 図において、1 は電機子鉄心スロットで 1-1...1-12 はスロット番号を表す。前記電機子鉄心スロット 1 の中には電機子巻線 2 が巻装される。3 は整流子片、3-1...3-24 は整流子片番号を表す。4 はカーボンブラシ、5 は整流子、6 は整流子巻線結線部

(以下、「フック」という)、7 は電機子鉄心、8 は電機子鉄心端面絶縁部材、9 は電機子鉄心スロット絶縁部

材、10 は遠心力で電機子巻線が電機子鉄心スロットから飛び出さないよう保持する絶縁部材(以下、「ウェッジ」という)、11 は電機子巻線を絶縁固着するワニス等の有機液剤、12 は回転軸、13 は界磁鉄心、14 は界磁巻線、20 は巻線機のパフォーム、21 は巻線機のセンターガイドである。

【0005】 次に、従来例の動作について説明する。図では整流子 5 は α フックタイプで、整流子片 3 の数が 24、電機子鉄心スロット 1 の数が 12 の場合について示す。回転軸 12 に接続された 12 個のスロットを持つ電機子鉄心スロット 1 の両端面とこの両端面と繋がる回転軸部 12 には例えば、PET、PBT 等の樹脂及び紙等でできた電機子鉄心端面絶縁部材 8 を配置している。また、電機子鉄心スロット 1 の内部には例えば、ポリエステルフィルム及び紙等でできた電機子鉄心スロット絶縁部材 9 を配置している。整流子 5 は電機子鉄心スロット 1 と 2 倍の整流子片 3 を備えている。

【0006】 通常、巻線機の 2 つの巻線フライヤーにて、電機子巻線 2-1 と 2-2 を同時に電機子鉄心スロット 1-1 及び 1-6 内と 1-7 及び 1-12 内に収納されながら複数回重ねて巻線された電機子巻線 2 は、巻線後に末端を整流子 5 のフック 6 に α 状に巻付け (α フック方式) ながら結線され、2 本の電機子巻線 2 はそれぞれ次の電機子鉄心スロット 1 に順次 2 つの巻線フライヤーで連続的に巻線されて、全周に渡り巻装した 12 個の電機子巻線 2 が電機子コイルを構成し、それぞれ巻始めから数えて 13 個目の整流子片 3 に電機子巻線 2 の末端が接続されるよう電機子を構成する。電機子結線終了後、フック 6 を加圧しながらヒュージングにて電機子巻線 2 と前記フック 6 を熱溶着接続させる。

【0007】 しかしながら、線径 $\phi 0.5$ 以上の電機子巻線 2 を α 状に巻線した場合、図 34 に示すように、線径が太いため電機子巻線 2 の剛性が強くフック 6 の両側では電機子巻線 2 の屈曲部の R が大きく張り出してしまうため、隣あったフック 6 との線間距離を確保できず、絶縁不良が起こりやすい。また、太線をヒュージングする際、細線に比べて熱溶着するためには、大電流が流れ加圧力も強くなるのでヒュージング不良や断線不良を起こしやすい。さらに、線径が大きくなると電機子巻線 2 の剛性が強いので、巻線時にフック 6 が変形してしまうという問題も発生する。

【0008】 また、図のように線径が太いと電機子巻線 2 の剛性が強く、巻線テンションも十分にかからないため巻線を最小径で巻くことができない。電機子鉄心スロット 1 内での太線化による占積率の拡大でウェッジ 10 の挿入スペースがなくなる恐れもある。さらに、整流子 5 と電機子鉄心スロット 1 間の巻線部が大きくなることから電機子巻線 2 を絶縁固着するワニス 11 を流下するとこのワニス 11 が整流子 5 表面に流れ込み整流不良を起こす恐れが生ずる。また、フック 6 における太線接続

後の線間距離を目視確認する必要があり工数増加による生産性低下にもつながる恐れがある。

【0009】また、図35のように巻線機の所定の位置にフライヤー（図示せず）を固定した主軸の一端に取り付けたフォーム20を設け、このフォーム30とセンタガイド21に沿って電機子巻線2を巻回して電機子鉄心7の外周面に形成された電機子鉄心スロット1に挿入するようにしたもので、電機子巻線2はフォーム20に沿ってセンターより $15^{\circ} \pm 10^{\circ}$ 傾いた角度より電機子鉄心スロット1へ案内される。これらのフォーム20は、電機子鉄心7を挟持するチャック（図示せず）に固定され、最後のスロットまで電機子巻線2が巻けるように途中、電機子がインデックスする時、フォーム20がコイルエンドに干渉しないように逃げを設けている。そのため、フォーム20は電機子巻線2を電機子鉄心スロット1の入口までしか案内できず、フォーム20の先端から飛んだ電機子巻線2は弛んで電機子鉄心スロット1の中で自由な状態になる。電機子鉄心スロット1の開口巾 β は、巻線投入角度により実際は $\beta/2$ に近い値となるため、フライヤーより繰り出される電機子巻線2の線径が $\phi 0.5\text{mm}$ 以上の場合、電機子巻線2が電機子鉄心スロット1の開口部に接触して加工劣化を起こす恐れがある。

【0010】

【発明が解決しようとする課題】従来の整流子電動機の電機子巻線の巻線方法は以上のように構成されているので、電機子巻線2の線径が $\phi 0.45\text{mm}$ 以下の比較的小さい線径のものには問題がないが、電機子巻線2の線径が $\phi 0.5\text{mm}$ 以上の巻線については、電機子巻線2のフック6での線間距離は安定して確保することが難しくなり、フック6に対するヒュージング不良や断線、フック6の変形、また電機子巻線2が電機子鉄心スロット1の開口部に接触して加工劣化を起こす恐れがあるなど、品質上の問題点が多くなる。更にまた、太線化により巻径が大きくなることによる弊害も起こり、なお且つ、電機子巻線接続後の線間距離を目視確認する必要があり工数増加による生産性低下にもつながる。

【0011】この発明は上記のような問題点を解決するためになされたもので、電機子巻線の線径を太くすることなく銅損低減による高効率化が可能となり、また1回目と2回目の巻回数を変えることができるために入力の微調整が行え、さらに整流子のフックにおける線間距離を安定して確保でき、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決するような整流子電動機を提供することを目的としている。

【0012】

【課題を解決するための手段】この発明の請求項1の整流子電動機の電機子巻線の巻線方法について、電機子鉄心のスロットと同数の整流子片を備えた1スロットー1セグメント方式では、電機子コイルは、巻始めがそれぞ

れ対称位置にある各一对のスロットに対してそれぞれ少なくとも1回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に、各々の電機子巻線をそれから更に $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されている。

【0013】このように、電機子鉄心のスロットと同数の整流子片を備えた1スロットー1セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対して巻線された1本の電機子巻線を電機子鉄心のスロット全周（結果として2重）にわたって巻線を巻き回すことにより、2本の電機子巻線を電機子鉄心のスロット半周に巻線し、電機子巻線を1重に巻回すことと同じこととなるため、例えば、電機子巻線の線径が $\phi 0.45\text{mm}$ の場合、電機子巻線を2重に巻回すことにより、電機子巻線の線径が $\phi 0.65\text{mm}$ の場合に電機子巻線を1重に巻き回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。また、電機子巻線の線径が $\phi 0.45\text{mm}$ 以下であれば、細線であるため整流子フック部の線間距離を安定して確保することができ、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。

【0014】この発明の請求項2の整流子電動機について、電機子全導体数と界磁巻線数との比率が6以上：1となるよう設定する。このような巻線数の比率にすることで電機子巻線の変圧器作用による火花抑制効果を改善できる。このように、電機子巻線の巻数を多くし、界磁の鉄損及び銅損を減少させることで、効率向上と整流改善により寿命を従来より1.2倍長くすることが可能となる。

【0015】この発明の請求項3の整流子電動機について、電機子巻線の中心と界磁極の中心との位相角度を $10^{\circ} \sim 30^{\circ}$ の間になるよう設定する。このように配置することで、回転方向の次の電機子鉄心スロット内巻線との変圧器作用による火花抑制効果により火花発生が少なく、ブラックバー現象を抑制することができるとともにブラシの寿命の向上を図ることができる。

【0016】この発明の請求項4の整流子電動機の電機子巻線について、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロットー2Nセグメント方式では、電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットに対してそれぞれスロット数に対して整数倍の整流子片と同じ数だけ

巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に、各々の電機子巻線をそれから更に $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されている。

【0017】このように、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された1本の電機子巻線を電機子鉄心のスロット全周（結果としてスロット数に対して整数倍重）にわたって巻線を巻き回すことにより、スロット数は整流子片の数の1/整数倍となって実質的に1本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す1スロット-1セグメント方式の巻線形態と同じになるため、請求項1で述べた1スロット-1セグメント方式と同じように性能改善効果と生産性向上による効果を得ることができる。

【0018】この発明の請求項5の整流子電動機の電機子巻線について、電機子鉄心のスロットと同数の整流子片を備えた1スロット-1セグメント方式では、電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットの数に対してそれぞれ2本並列にして少なくとも1回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N/2+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されている。

【0019】このように、電機子鉄心のスロットと同数の整流子片を備えた1スロット-1セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対して巻線された2本並列にした電機子巻線を電機子鉄心のスロット半周にわたって巻線することにより、実質的に1本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す1スロット-1セグメント方式の巻線形態と同じになるため、請求項1で述べた1スロット-1セグメント方式と同じように性能改善効果と生産性向上による効果を得ることができる。

【0020】この発明の請求項6の整流子電動機の電機子巻線について、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式では、電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットの数に対してそれぞれスロット数に対して整数倍の整流子片と同じ数の複数の線をその数だけ巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N/2+$

1個目の整流子片に電機子巻線の末端がそれぞれ接続されるように巻線して形成されている。

【0021】このように、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された2本の電機子巻線を電機子鉄心のスロット全周（結果としてスロット数に対して整数倍重）にわたって巻線を巻き回すことにより、スロット数は整流子片の数の1/整数倍となって実質的に1本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す1スロット-1セグメント方式の巻線形態と同じになるため、請求項1で述べた1スロット-1セグメント方式と同じように性能改善効果と生産性向上による効果を得ることができる。

【0022】この発明の請求項7の整流子電動機の電機子巻線について、整流子にN個の電機子鉄心スロットと同数の整流子片を備えた1スロット-1セグメント方式では、電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットに対してそれぞれ少なくとも1回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に一旦切断し、各々の電機子巻線の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置から $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N/2+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるよう巻線して形成されている。

【0023】このように、電機子鉄心のスロットと同数の整流子片を備えた1スロット-1セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対して巻線された1本の電機子巻線を互いに電機子鉄心のスロットの半周ずつ全周にわたって巻線する際に、残りの半周の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置から $N/2$ 個目の対スロットまで順次巻線することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1つのスロット内における1回目と2回目の巻線バランスがよくなり、電機子の初期アンバランスを30%削減でき、電機子バランス修正の改善につながる。

【0024】この発明の請求項8の整流子電動機の電機子巻線について、整流子にN個の電機子鉄心スロットと同数の整流子片を備えた1スロット-1セグメント方式では、一对のスロット内の電機子巻線で1回目と2回目の巻線抵抗がほぼ同じになるように巻数が1回目>2回目となり、その比率が1.1~1.4となるよう設定する。

【0025】このように、整流子にN個の電機子鉄心スロットと同数の整流子片を備えた1スロット-1セグメ

10

20

30

40

50

ント方式で、一对のスロット内の電機子巻線で1回目と2回目の巻数が1回目>2回目となり、その比率が1.1~1.4となるようにすることにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1回目と2回目における巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので寿命の改善も期待できる。また、今までどおり1回巻、もしくは1回目と2回目の巻数が同数の仕様では巻数は $1 \times 8T$ 、 $1 \times 9T$ と整数値でしか表すことができなかったが、1回目と2回目の巻数仕様を変えることで $1 \times 8.5T$ 、 $1 \times 9.5T$ と巻線仕様の中を広げることができ、入力調整を巻線仕様にて行う際、従来に比べ大変有利となる。

【0026】この発明の請求項9の整流子電動機の電機子巻線について、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式では、電機子コイルは、電機子コイルは、巻始めがそれぞれ対称位置にある各一对のスロットに対してそれぞれスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、 $N/2$ 個目の対スロットまで順次巻線し、その $N/2$ 個目の対スロット巻線後に一旦切断し、各々の電機子巻線の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置から $N/2$ 個目の対スロットまで順次巻線し、巻始めから数えて $N+1$ 個目の整流子片に電機子巻線の末端がそれぞれ接続されるよう巻線して形成されている。

【0027】このように、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された1本の電機子巻線を互いに電機子鉄心のスロットの半周ずつ全周にわたって巻線する際に、残りの半周の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置から $N/2$ 個目の対スロットまで順次巻線することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1つのスロット内における1回目と2回目の巻線バランスがよくなり、電機子の初期アンバランスを30%削減でき、電機子バランス修正の改善につながる。

【0028】この発明の請求項10の整流子電動機の電機子巻線について、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式では、整流子にN個の電機子鉄心スロットと同数の整流子片を備えた1スロット-1セグメント方式では、一对のスロット内の電機子巻線で1回目と2回目の巻線抵抗がほぼ同じになるように巻数が1回目>2回目となり、その比率が1.1~1.4となるよう設定する。

【0029】このように、電機子鉄心のスロットの数に

対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式で、一对のスロット内の電機子巻線で1回目と2回目の巻数が1回目>2回目となり、その比率が1.1~1.4となるようにすることにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1回目と2回目における巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので寿命の改善も期待できる。また、今までどおり1回巻、もしくは1回目と2回目の巻数が同数の仕様では巻数は $1 \times 8T$ 、 $1 \times 9T$ と整数値でしか表すことができなかったが、1回目と2回目の巻数仕様を変えることで $1 \times 8.5T$ 、 $1 \times 9.5T$ と巻線仕様の中を広げることができ、入力調整を巻線仕様にて行う際、従来に比べ大変有利となる。

【0030】

【発明の実施の形態】

発明の実施の形態1

以下、この発明の実施の形態1を図について説明する。図1はこの発明の実施の形態1を表す整流子電動機の巻線結線図、図2は整流子電動機の電機子整流子部上面図、図3は整流子結線側面図、図4は整流子電動機の整流子結線部部分拡大図である。図において、1は電機子鉄心スロット、1-1...1-22はスロット番号を表す。2は電機子巻線、前記電機子鉄心スロット1の中には順次電機子巻線が装着され、図1には電機子巻線2-1、2-2を例示した。3は整流子片、3-1...3-22は整流子片の番号を表す。4はカーボン刷子、5は整流子、6は整流子結線部であるフック、7は電機子鉄心、8は電機子鉄心端面絶縁部材、9は電機子鉄心スロット絶縁部材、10は遠心力で電機子巻線が電機子鉄心スロットから飛び出さないよう保持する絶縁部材であるウェッジ、11は電機子巻線を絶縁固着するワニス等の有機溶剤、12は回転軸である。

【0031】次に、電機子コイルの巻線形態について説明する。図1から図4に示すように、整流子片3の数が22、電機子鉄心スロット1の数が22の場合（これを「1スロット-1セグメント方式」という）である。2つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線2-1、2-2を同時に巻線を開始する。電機子巻線2-1は巻始めが整流子片3-1に接続し、スロット1-1及び1-10内に巻装され、巻終わりが整流子片3-2に接続する。もう一方の電機子巻線2-2は巻始めが整流子片3-12に接続し、スロット1-12及び1-21内に巻装され、巻終わりが整流子片3-13に接続する。

【0032】以下、同様に電機子鉄心スロット1の半周にわたり巻装し、それぞれの電機子巻線2-1は巻終わりが整流子片3-12、電機子巻線2-2の巻終わりが整流子片3-1に接続後、末端を切断せず、電機子巻線2-1はスロット1-12及び1-21内に巻装され、

10

20

30

40

50

巻終わりが整流子片3-13に接続する。また、電機子巻線2-2はスロット1-1及び1-10内に巻装され、巻終わりが整流子片3-2に接続する。このように、さらにもう1回電機子鉄心スロット1のさらに半周にわたり巻装し、電機子巻線2-1の最終的な巻終りが整流子片3-1に接続され、また、電機子巻線2-2の最終的な巻終りが整流子片3-12に接続されて切断される。図において、Pは電機子巻線2の回転方向を示している。また、カーボンブラシ4の図示位置は電機子巻線2を構成する電機子巻線2が整流を完了する寸前に対応している。

【0033】このように、電機子鉄心スロット1と同数の整流子片3を備えた1スロット-1セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心7の各一对のスロットに対して巻線された1本の電機子巻線2を電機子鉄心スロット1の全周（結果として2重）にわたって巻線を巻き回すことにより、2本の電機子巻線2を電機子鉄心スロット1の半周に巻線し、電機子巻線2を1重に巻き回すことと同じこととなるため、例えば、電機子巻線2の線径が $\phi 0.45\text{ mm}$ の場合、電機子巻線2を2重に巻回すことにより、電機子巻線2の線径が $\phi 0.65\text{ mm}$ の場合に電機子巻線2を1重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【0034】また、電機子巻線2の線径が $\phi 0.45\text{ mm}$ 以下であれば、細線であるため整流子のフック6における線間距離を安定して確保することができ、フック6に対するヒュージング不良や断線、フック6の変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。

【0035】発明の実施の形態2

次に、この発明の実施の形態2を図について説明する。図5は界磁鉄心と電機子鉄心を上から見た図。図6は巻数比率とカーボンブラシの寿命のグラフ。図7は整流子電動機の側面図。この発明の実施の形態2は発明の実施の形態1の変形例である。図において、この発明の実施の形態1と同一の構成は同一符号を付して重複した構成の説明を省略する。13は界磁鉄心、14は界磁巻線、19は整流子電動機である。図5及び図6に示すように、電機子巻線2の全導体数と界磁巻線14の数との比率が6以上：1となるよう設定することで電機子巻線2の変圧器作用による火花抑制効果を改善でき火花発生が小さくなる。このように電機子巻線2の巻数を多くし、界磁の鉄損及び銅損を減少させることで、効率向上と整流改善により寿命を従来より1.2倍長くすることが可能となる。

【0036】電機子巻線2の全導体数と界磁巻線14の数との比率が6以上：1となるよう設定することにより、効率向上と整流改善が図られる理由を以下に説明する。カーボンブラシは回転体である電機子の一部分である整流子との間で電流通電を行い、発電機或いは電動機においては、カーボンブラシによって短絡されている。電機子コイルの電流が、接触期間中に電氣的に電流取り出し方向を180度反転する際に流れる短絡電流を抑える作用を行っている。これは、電機子の各コイルが1回転毎に2回カーボンブラシで、短絡され、その都度コイル内の電流は+1から-1へ、次には-1から-1へと方向を反転させているため、その時間は電機子コイルがカーボンブラシで短絡された瞬間から始まり、短絡が解除される時に終わるもので、極めて短時間である。

【0037】そして、不足整流の時には磁束の遅れがあり、電流とともに変化するリアクタンス電圧を打消しきれないため、磁束の遅れがある限度以上になると整流の終了時に電流変化が大きくなり、ブラシの出口から火花が発生しやすくなる。また、過整流の時には不足整流と反対に磁束の進み具合が速くなり、同様な現象を起こしやすくなる。反対に最も望ましいのが短絡電流がカーボンブラシの接触面積に比例した電流分布となる直線整流の状態である。この状態を作るには、電機子巻線のインダクタンスLと整流時間Tと電機子巻線抵抗Rの関係が、 $L < RT$ となることで満足され、この直線整流を行うためのRを実験にて確認した結果、図6に示したように RT 全導体数/S T巻線の比率が6以上になるよう巻き線仕様を設定した時の電機子巻線抵抗Rを大きくすることで、整流改善ができ、効率向上と寿命を長くすることができる。

【0038】発明の実施の形態3

次に、この発明の実施の形態3を図について説明する。図8は整流子電動機の電機子巻線の巻線配置を示す結線図、図9は位相角のズレとカーボンブラシの寿命のグラフである。この発明の実施の形態3は発明の実施の形態1の変形例である。図において、この発明の実施の形態1と同一の構成は同一符号を付して重複した構成の説明を省略する。16は界磁極である。図8に示すように、電機子巻線2の中心と界磁極16の中心との位相角度Xを $10^\circ \sim 30^\circ$ の間になるよう設定する。このように配置することで、回転方向の次のスロット内巻線との変圧器作用による火花抑制効果により火花発生が少なく、ブラックバー現象を抑制することができると共にブラシの寿命の向上を図ることができる。なお、図9は定格電圧100Vで入力1300Wの整流子電動機21におけるカーボンブラシの寿命特性を示す。

【0039】ここに、位相角度Xとは、幾何学的な中性軸X-Yと電氣的中性軸X'-Y'とがなす角度 α をいい、一般には電機子の回転方向と逆方向を正としている。通常、この角度 α の調整は界磁及びカーボンブラシ

の軸は固定しておき、整流子への電機子コイルリードの接続角度を変えることで行われている。この接続角度は通常、電機子コアスロットに対する整流子の圧入角度で調整する。この最適位相角度を実験的に求めたところ、図 9 に示すように $10 \sim 30^\circ$ に設定することで、流れる電流によって生じる磁束の向きが電機子巻線の変圧器作用によって火花抑制効果を期待できる位置にくるので火花発生が小さくなり、整流改善ができ、効率向上と寿命を長くすることができる。ゆえに、界磁と電機子コアスロットの中心から整流子の圧入角度をずらして設定する効果がある。

【0040】発明の実施の形態 4

次に、この発明の実施の形態 4 を図について説明する。図 10 はこの発明の実施の形態を表す整流子電動機の巻線結線図、図 11 は整流子電動機の整流子結線部部分拡大図である。図において、この発明の実施の形態 1 と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図 10 及び図 11 に示すように、整流子片 3 の数が 24、電機子鉄心スロット 1 の数が 12 の場合（これを「1 スロット - 2 N セグメント方式」という）である。2 つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線 2-1、2-2 を同時に巻線を開始する。電機子巻線 2-1 はスロット 1-1 及び 1-6 内に巻装され、巻始めが整流子片 3-1 に接続し、巻終りが整流子片 3-2 に接続する。そして、再度スロット 1-1 及び 1-6 内に巻装されて、その巻終りは整流子片 3-2 の隣の整流子片 3-3 に接続する。このような巻線方法で、順序よく巻線方向に沿って巻線を行い、電機子コイルを形成する。

【0041】同様に電機子巻線 2-2 はスロット 1-7 及び 1-12 内に巻装され、巻始めが整流子片 3-13 に接続し、巻終りが整流子片 3-14 に接続する。そして、再度スロット 1-7 及び 1-12 内に巻装されて、その巻終りは整流子片 3-14 の隣の整流子片 3-15 に接続する。以下、同様に電機子鉄心スロット 1 のスロット数 12 の半周にわたり巻装し、それぞれの電機子巻線 2-1 の巻終りが 3-13 に、電機子巻線 2-2 の巻終りが 3-1 に接続後、切断せず、電機子巻線 2-1 はスロット 1-7 及び 1-12 内に巻装され、巻終りが 3-14 に接続する。電機子巻線 2-2 はスロット 1-1 及び 1-6 内に巻装され、巻終りが整流子片 3-2 に接続する。

【0042】このように、さらにもう 1 回電機子鉄心スロット 1 のさらに半周にわたり巻装し、電機子巻線 2-1 の最終的な巻終りが整流子片 3-1 に接続され、また、電機子巻線 2-2 の最終的な巻終りが整流子片 3-13 に接続されて切断される。図において、P は電機子巻線 2 の回転方向を示している。このように、1 つの電機子巻線 2 で 2 重巻線をする事で電機子巻線 2 を並列

に巻線したことと同じ効果となるため、例えば、電機子巻線 2 の線径が $\phi 0.45 \text{ mm}$ の場合、2 重に巻回すことにより $\phi 0.65 \text{ mm}$ と同等の断面積を得られる。

【0043】このように、電機子鉄心スロット 1 の数に対して整流子 5 に 2 倍の整流子片 3 を備えた 1 スロット - 2 N セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心 7 の各一对のスロットに対してスロット数に対して 2 倍の整流子片 3 と同じ数だけ巻線された 1 本の電機子巻線 2 を電機子鉄心スロット 1 の全周にわたって巻線を巻き回すことにより、スロット数は整流子片 3 の数の $1/2$ 倍となって実質的に 1 本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す 1 スロット - 1 セグメント方式の巻線形態と同じになるため、例えば、電機子巻線 2 の線径が $\phi 0.45 \text{ mm}$ の場合、電機子巻線 2 を 2 重に巻回すことにより、電機子巻線 2 の線径が $\phi 0.65 \text{ mm}$ の場合に電機子巻線 2 を 1 重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【0044】また、電機子巻線 2 の線径が $\phi 0.45 \text{ mm}$ 以下であれば、細線であるため整流子のフック 6 における線間距離を安定して確保することができ、フック 6 に対するヒュージング不良や断線、フック 6 の変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。なお、この発明の実施の形態 4 では整流子片 3 の数が 24、電機子鉄心スロット 1 の数が 12 の場合について述べたが、整流子片 3 の数が、電機子鉄心スロット 1 の数の整数倍の場合には各一对のスロットに対してスロット数に対して整数倍の整流子片 3 と同じ数だけ巻線された 1 本の電機子巻線 2 を電機子鉄心スロット 1 の全周にわたって巻線を巻き回すことになる。

【0045】発明の実施の形態 5

次に、この発明の実施の形態 5 を図について説明する。

図 12 はこの発明の実施の形態を表す整流子電動機の巻線結線図である。図 13 は整流子電動機の整流子結線部部分拡大図である。図 14 は整流子電動機の電機子整流子部上面図である。図において、この発明の実施の形態 1 と同一の構成は同一符号を付して重複した構成の説明を省略する。17 は並列巻線用電機子巻線である。次に、電機子コイルの巻線形態について説明する。図 12 及び図 13 に示すように、整流子片 3 の数が 22、電機子鉄心スロット 1 の数が 22 の場合（1 スロット - 1 セグメント方式）である。2 つの巻線フライヤーを持つ巻線機で、1 つの巻線フライヤーにより、巻始めがそれぞれ対称位置にある 2 本の電機子巻線 2-1、17-1 と 2 本の電機子巻線 2-2、17-2 を並列に並べて同時

に巻線を開始する。

【0046】電機子巻線 2-1、17-1 は巻始めが整流子片 3-1 に接続し、スロット 1-1 及び 1-10 内に巻装され、巻終りが整流子片 3-2 に接続する。また、電機子巻線 2-2、17-2 は巻始めが整流子片 3-12 に接続し、スロット 1-12 及び 1-21 内に巻装され、巻終りが整流子片 3-13 に接続する。以下、同様に電機子鉄心スロット 1 の半周にわたり巻装し、それぞれの電機子巻線 2-1、17-1 の巻終りが 3-12、それぞれの電機子巻線 2-2、17-2 の巻終りが 3-1 に接続されるよう巻線する。

【0047】このように、電機子鉄心スロット 1 と同数の整流子片 3 を備えた 1 スロット-1 セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心 7 の各一对のスロットに対して巻線された 2 本並列にした電機子巻線 2 を電機子鉄心スロット 1 の半周にわたって巻線することにより、実質的に 1 本の電機子巻線 2 を電機子鉄心スロット 1 の全周にわたって巻線を巻き回す 1 スロット-1 セグメント方式の巻線形態と同じになるため、例えば、電機子巻線 2 の線径が $\phi 0.45\text{mm}$ の場合、電機子巻線 2 を 2 重に巻き回すことにより、電機子巻線 2 の線径が $\phi 0.65\text{mm}$ の場合に電機子巻線 2 を 1 重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【0048】また、電機子巻線 2 の線径が $\phi 0.45$ 以下であれば、細線であるため整流子のフック 6 における線間距離を安定して確保することができ、フック 6 に対するヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。

【0049】発明の実施の形態 6

次に、この発明の実施の形態 6 を図について説明する。図 15 はこの発明の実施の形態を表す整流子電動機の巻線結線図である。図 16 は整流子電動機の整流子結線部分拡大図である。この発明の実施の形態 1 と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図 15 及び図 16 に示すように、整流子片 3 の数が 24、電機子鉄心スロット 1 の数が 12 の場合 (1 スロット-2 N セグメント方式) である。2 つの巻線フライヤーを持つ巻線機で、1 つの巻線フライヤーにより、巻始めがそれぞれ対称位置にある 2 本の電機子巻線 2-1、17-1 と 2 本の電機子巻線 2-2、17-2 を並列に並べて同時に巻線を開始する。

【0050】電機子巻線 2-1、17-1 はスロット 1

-1 及び 1-6 内に巻装され、巻始めが整流子片 3-1 に接続し、巻終りが整流子片 3-2 に接続する。そして、再度スロット 1-1 及び 1-6 内に巻装されて、その巻終りは整流子片 3-2 の隣の整流子片 3-3 に接続する。このように、電機子巻線 2-1、17-1 が電機子コイルを形成する。同様に電機子巻線 2-2、17-2 はスロット 1-7 及び 1-12 内に巻装され、巻始めが整流子片 3-13 に接続し、巻終りが整流子片 3-14 に接続する。そして、再度スロット 1-7 及び 1-12 内に巻装されて、その巻終りは整流子片 3-14 の隣の整流子片 3-15 に接続する。以下、同様に電機子鉄心スロット 1 のスロット数 12 の半周にわたり巻装し、それぞれの電機子巻線 2-1、17-1 の巻終りが 3-13 に、2-2、17-2 の巻終りが 3-1 に接続されるよう巻線する。

【0051】このように、電機子鉄心スロット 1 の数に対して整流子 5 に 2 倍の整流子片 3 を備えた 1 スロット-2 N セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心 7 の各一对のスロットに対してスロット数に対して 2 倍の整流子片 3 と同じ数だけ巻線された 2 本の電機子巻線 2 を電機子鉄心のスロット 1 の全周にわたって巻線を巻き回すことにより、スロット数は整流子片 3 の数の $1/2$ 倍となつて実質的に 1 本の電機子巻線 2 を電機子鉄心スロット 1 の全周にわたって巻線を巻き回す 1 スロット-1 セグメント方式の巻線形態と同じになるため、例えば、電機子巻線 2 の線径が $\phi 0.45\text{mm}$ の場合、電機子巻線 2 を 2 重に巻き回すことにより、電機子巻線 2 の線径が $\phi 0.65\text{mm}$ の場合に電機子巻線 2 を 1 重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【0052】また、電機子巻線 2 の線径が $\phi 0.45\text{mm}$ 以下であれば、細線であるため整流子のフック 6 における線間距離を安定して確保することができ、フック 6 に対するヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。なお、この発明の実施の形態 6 では整流子片 3 の数が 24、電機子鉄心スロット 1 の数が 12 の場合について述べたが、整流子片 3 の数が電機子鉄心スロット 1 の数の整数倍の場合には各一对のスロットに対してスロット数に対して整数倍の整流子片 3 と同じ数だけ巻線された本数の電機子巻線を電機子鉄心のスロット 1 の全周にわたって巻線を巻き回すことになる。

【0053】発明の実施の形態 7

次にこの発明の実施の形態 7 を図について説明する。図 17 はこの発明の実施の形態を表す整流子電動機の巻線

結線図、図 18 は整流子電動機の整流子結線部部分拡大図、図 19 は整流子電動機の電機子整流子部上面図である。図において、この発明の実施の形態 1 と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図 17 から図 19 に示すように、整流子片 3 の数が 22、電機子鉄心スロット 1 の数が 22 の場合（1 スロットー 1 セグメント方式）である。

【0054】2つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線 2-1、2-2 を同時に巻線を開始する。電機子巻線 2-1 は巻始めが整流子片 3-1 に接続し、スロット 1-1 及び 1-10 内に巻装され、巻終りが整流子片 3-2 に接続する。電機子巻線 2-2 は巻始めが整流子片 3-12 に接続し、スロット 1-12 及び 1-21 内に巻装され、巻終りが整流子片 3-13 に接続する。以下、同様に電機子鉄心スロット 1 の半周にわたり巻装し、それぞれの電機子巻線 2-1 の巻終りが 3-12、2-2 の巻終りが 3-1 に接続後、一端切断する。

【0055】次に、切断したところから回転方向に数えて 2 セグメント位置をずらしたところから電機子巻線 2-1、2-2 に相当する 2-3、2-4 を 1 回目と同様、同時に巻線を開始する。電機子巻線 2-3 は巻始めが整流子片 3-3 に接続し、スロット 1-3 及び 1-12 内に巻装され、巻終りが整流子片 3-4 に接続する。電機子巻線 2-4 は巻始めが整流子片 3-14 に接続し、スロット 1-14 及び 1-1 内に巻装され、巻終りが整流子片 3-15 に接続する。以下、同様に電機子鉄心スロット 1 のさらに半周にわたり巻装し、それぞれの電機子巻線 2-3 の巻終りが 3-14 に、電機子巻線 2-2 の巻終りが 3-3 に接続する。

【0056】このように、電機子鉄心スロット 1 と同数の整流子片 3 を備えた 1 スロットー 1 セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心 7 の各一对のスロットに対して巻線された 1 本の電機子巻線 2 を互いに電機子鉄心スロット 1 の半周ずつ全周にわたって巻線する際に、残りの半周の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置から $N/2$ 個目の対スロットまで順次巻線することにより、請求項 1 で述べた方式と同じ効果を得ることができ、さらに 1 つのスロット内における 1 回目と 2 回目の巻線バランスがよくなり、電機子の初期アンバランスを 30% 削減でき、電機子バランス修正の改善につながる。

【0057】発明の実施の形態 8

次に、この発明の実施の形態 8 を図について説明する。図 20 はこの発明の実施の形態を表す整流子電動機の電機子整流子部上面図である。図において、この発明の実施の形態 1 と同一の構成は同一符号を付して重複した構成の説明を省略する。発明の実施の形態 7 では、2 回目となる残りの半周の巻始めをそれから 2 セグメント位置

をずらしたところから開始していたが、この発明の実施の形態 8 では、2 回目の巻線開始位置を次の整流子片 3 から数えて $60^\circ \sim 120^\circ$ 先の整流子片 3 から巻始める。巻き方は発明の実施の形態 7 と同じであるため具体的説明は省略する。このような電機子巻線の巻線方法により前項に述べた方式と同じ効果を得ることができ、また、2 回目の巻線を $90^\circ \pm \alpha$ から巻線を殆めているため、電機子の初期アンバランスを約 30% 削減でき、電機子バランス修正の改善につながる。

10 【0058】発明の実施の形態 9

次に、この発明の実施の形態 9 を図について説明する。図 21 はこの発明の実施の形態を表す巻数比率と寿命のグラフ、図 22 は巻数仕様と入力グラフ、図 23 は電機子巻線が巻線された電機子鉄心スロット部の切斷拡大図である。図において、この発明の実施の形態 1 と同一の構成は同一符号を付して重複した構成の説明を省略する。この発明の実施の形態 9 は、発明の実施の形態 1 及び 7 のように、電機子鉄心スロット 1 と同数の整流子片 3 を備えた 1 スロットー 1 セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心 7 の各一对のスロットに対して巻線された 1 本の電機子巻線 2 を互いに電機子鉄心スロット 1 の半周ずつ全周にわたって巻線する（即ち、各一对のスロットに対して 1 本の電機子巻線が二重巻きする）場合に、対スロット内の巻線で 1 回目と 2 回目の巻線抵抗がほぼ同じになるように巻数が 1 回目 > 2 回目となり、その比率が 1.1 ~ 1.4 となるよう設定する。

【0059】このように設定することにより、請求項 1 で述べた方式と同じ効果を得ることができ、さらに 1 回目と 2 回目における巻線形状及び巻線抵抗が均一となり、整流バランスが改善できるので、図 22 に示すとおり寿命の改善も期待できる。また、今までどおり 1 回巻、もしくは 1 回目と 2 回目の巻数が同数の仕様では巻数は $1 \times 8T$ 、 $1 \times 9T$ と整数値でしか表すことができなかったが、図 23 に示すとおり 1 回目と 2 回目の巻数仕様を変えることで $1 \times 8.5T$ 、 $1 \times 9.5T$ と巻線仕様の中を広げることができることで、入力の調整を巻線仕様にて行う際、従来に比べ大変有利となる。

【0060】発明の実施の形態 10

次に、この発明の実施の形態 10 について説明する。図 24 はこの発明の実施の形態を表す整流子電動機の巻線結線図、図 25 は整流子電動機の整流子線部部分拡大図である。図において、この発明の実施の形態 1 と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図 24 及び図 25 に示すように、整流子片 3 の数が 24、電機子鉄心スロット 1 の数が 12 の場合（1 スロットー 2N セグメント方式）である。

【0061】2つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線 2-1、2-

2を同時に巻線を開始する。電機子巻線2-1はスロット1-1及び1-6内に巻装され、巻始めが整流子片3-1に接続し、巻終りが整流子片3-2に接続する。そして、再度スロット1-1及び1-6内に巻装されて、その巻終りは整流子片3-2の隣の整流子片3-3に接続する。このような巻線方法で、順序よく巻線方向に沿って巻線を行い、電機子コイルを形成する。同様に電機子巻線2-2はスロット1-7及び1-12内に巻装され、巻始めが整流子片3-13に接続し、巻終りが整流子片3-14に接続する。そして、再度スロット1-7及び1-12内に巻装されて、その巻終りは整流子片3-14の隣の整流子片3-15に接続する。以下、同様に電機子鉄心スロット1のスロット数12の半周にわたり巻装し、それぞれの電機子巻線2-1の巻終りが3-13に、2-2の巻終りが3-1に接続後、一旦切断する。

【0062】次に、切断したところから、回転方向に数えて2セグメント位置をずらしたところから、電機子巻線2-1、2-2を1回目と同様、同時に巻き線を開始する。電機子巻線2-1はスロット1-7及び1-12内に巻装され、巻終りが3-14に接続する。電機子巻線2-2はスロット1-1及び1-6内に巻装され、巻終りが整流子片3-2に接続する。このように、さらにもう1回電機子鉄心スロット1のスロット数12のさらに半周にわたり巻装し、電機子巻線2-1の最終的な巻終りが整流子片3-1に接続され、また、電機子巻線2-2の最終的な巻終りが整流子片3-13に接続されて切断される。

【0063】このように、電機子鉄心スロット1の数に対して整流子5に2倍の整流子片3を備えた1スロット-2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心7の各一对のスロットに対してスロット数に対して2倍の整流子片3と同じ数だけ巻線された1本の電機子巻線2を互いに電機子鉄心スロット1の半周ずつ全周にわたって巻線する際に、残りの半周の巻始めをそれから2セグメント位置をずらしたところから開始し、ずらせた位置からN/2個目の対スロットまで順次巻線することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1つのスロット内における1回目と2回目の巻線バランスがよくなり、電機子の初期アンバランスを30%削減でき、電機子バランス修正の改善につながる。

【0064】発明の実施の形態11

次に、この発明の実施の形態11を図について説明する。発明の実施の形態10では、2回目となる残りの半周の巻始めをそれから2セグメント位置をずらしたところから開始していたが、この発明の実施の形態11では、2回目の巻線開始位置を次の整流子片3から数えて60°～120°先の整流子片3から巻始める。巻き方は発明の実施の形態10と同じであるため具体的説明は

省略する。このような電機子巻線の巻線方法により前項に述べた方式と同じ効果を得ることができ、また、2回目の巻線を90°±αから巻線を殆めているため、電機子の初期アンバランスを約30%削減でき、電機子バランス修正の改善につながる。さらに、巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので寿命の改善も期待できる。

【0065】発明の実施の形態12

この発明の実施の形態12は、発明の実施の形態4及び10のように、電機子鉄心スロット1の数に対して整流子5に2倍の整流子片3を備えた1スロット-2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心7の各一对のスロットに対して巻線された1本の電機子巻線2を互いに電機子鉄心スロット1の半周ずつ全周にわたって巻線する（即ち、各一对のスロットに対して1本の電機子巻線が二重巻きする）場合に、対スロット内の巻線で1回目と2回目の巻線抵抗がほぼ同じになるように巻数が1回目>2回目となり、その比率が1.1～1.4となるよう設定する。

【0066】このように設定することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1回目と2回目における巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので、図22に示すとおり寿命の改善も期待できる。また、今までどおり1回巻、もしくは1回目と2回目の巻数が同数の仕様では巻数は1×8T、1×9Tと整数値でしか表すことができなかったが、1回目と2回目の巻数仕様を変えることで1×8.5T、1×9.5Tと巻線仕様の中を広げることができ、入力調整を巻線仕様にて行う際、従来に比べ大変有利となる。上述した発明の実施の形態ではいずれもαフック方式の整流子について説明したが、スタフィング方式（電機子巻線の結線を整流子上に設けられた溝に打ち込んで固定する方式）の整流子について適用できることはいうまでもない。

【0067】

【発明の効果】以上のように、この発明の請求項1の整流子電動機においては、電機子鉄心のスロットと同数の整流子片を備えた1スロット-1セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対して巻線された1本の電機子巻線を電機子鉄心のスロット全周（結果として2重）にわたって巻線を巻き回すことにより、2本の電機子巻線を電機子鉄心のスロット半周に巻線し、電機子巻線を1重に巻回すことと同じこととなるため、例えば、電機子巻線の線径がφ0.45mmの場合、電機子巻線を2重に巻回すことにより、電機子巻線の線径がφ0.65mmの場合に電機子巻線を1重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができるという効果を奏する。また、電機子巻線の線径がφ0.45mm以下であれば、細線である

ため整流子フック部の線間距離を安定して確保することができ、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる、なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなるという効果を奏する。

【0068】この発明の請求項2の整流子電動機においては、電機子全導体数と界磁巻線数との比率が6以上：1となるよう設定することにより、電機子巻線の変圧器作用による火花抑制効果を改善できるため、電機子巻線の巻数を多くし、界磁の鉄損及び銅損を減少させることで、効率向上と整流改善により寿命を従来より1.2倍長くすることが可能となる効果を奏する。

【0069】この発明の請求項3の整流子電動機においては、電機子巻線の中心と界磁極の中心との位相角度を $10^{\circ} \sim 30^{\circ}$ の間になるよう設定することにより、回転方向の次の電機子鉄心スロット内巻線との変圧器作用による火花抑制効果により火花発生が少なく、ブランク

パー現象を抑制することができるとともに刷子寿命の向上を図ることができるという効果を奏する。

【0070】この発明の請求項4の整流子電動機においては、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された1本の電機子巻線を電機子鉄心のスロット全周（結果としてスロット数に対して整数倍重）にわたって巻線を巻き回すことにより、スロット数は整流子片の数の $1/\text{整数倍}$ となって実質的に1本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す1スロット-1セグメント方式の巻線形態と同じになるため、1スロット-2Nセグメント方式でも、請求項1で述べた1スロット-1セグメント方式と同じように、例えば、電機子巻線の線径が $\phi 0.45\text{mm}$ の場合、電機子巻線を2重に巻回すことにより、電機子巻線の線径が $\phi 0.65\text{mm}$ の場合に電機子巻線を1重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができるという効果を奏する。また、電機子巻線の線径が $\phi 0.45\text{mm}$ 以下であれば、細線であるため整流子フック部の線間距離を安定して確保することができ、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる、なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなるという効果を奏する。

【0071】この発明の請求項5の整流子電動機において、電機子鉄心のスロットと同数の整流子片を備えた1スロット-1セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対して巻線された2本並列にした電機子巻線を電機子鉄心のスロット半周にわたって巻線することにより、実質的に1本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す1スロット-1セグメント方式の巻線形態と同じになるため、請求項1で述べた1スロット-1セグメント方式と同じように性能改善効果と生産性向上による効果を得ることができる。

【0072】この発明の請求項6の整流子電動機において、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロット-2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された2本の電機子巻線を電機子鉄心のスロット全周（結果としてスロット数に対して整数倍重）にわたって巻線を巻き回すことにより、スロット数は整流子片の数の $1/\text{整数倍}$ となって実質的に1本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す1スロット-1セグメント方式の巻線形態と同じになるため、請求項1で述べた1スロット-1セグメント方式と同じように性能改善効果と生産性向上による効果を得ることができる。

【0073】この発明の請求項7の整流子電動機において、電機子鉄心のスロットと同数の整流子片を備えた1スロット-1セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一对のスロットに対して巻線された1本の電機子巻線を互いに電機子鉄心のスロットの半周ずつ全周にわたって巻線する際に、一方の残りの半周の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置から $N/2$ 個目の対スロットまで順次巻線することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1つのスロット内における1回目と2回目の巻線バランスがよくなり、電機子の初期アンバランスを30%削減でき、電機子バランス修正の改善につながるという効果を奏する。

【0074】この発明の請求項8の整流子電動機において、整流子にN個の電機子鉄心スロットと同数の整流子片を備えた1スロット-1セグメント方式では、一对のスロット内の電機子巻線で1回目と2回目の巻線抵抗がほぼ同じになるように巻数が1回目 $>$ 2回目となり、その比率が $1.1 \sim 1.4$ となるよう設定することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1回目と2回目における巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので寿命の改善も期待できるという効果を奏する。また、今までどおり1回巻、もしくは1回目と2回目の巻数が同数の仕様では巻数は $1 \times 8\text{T}$ 、 $1 \times 9\text{T}$ と整数値でしか表すこと

ができなかったが、1回目と2回目の巻数仕様を変えることで1×8.5T、1×9.5Tと巻線仕様の中を広げることができることで、入力調整を巻線仕様にて行う際、従来に比べ大変有利となる。

【0075】この発明の請求項9の整流子電動機において、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロットー2Nセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一対のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された1本の電機子巻線を互いに電機子鉄心のスロットの半周ずつ全周にわたって巻線する際に、一方の残りの半周の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置からN/2個目の対スロットまで順次巻線することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1つのスロット内における1回目と2回目の巻線バランスがよくなり、電機子の初期アンバランスを30%削減でき、電機子バランス修正の改善につながるという効果を奏する。

【0076】この発明の請求項10の整流子電動機において、電機子鉄心のスロットの数に対して整流子に2倍以上の整数倍の整流子片を備えた1スロットー2Nセグメント方式では、整流子にN個の電機子鉄心スロットと同数の整流子片を備えた1スロットー1セグメント方式では、一対のスロット内の電機子巻線で1回目と2回目の巻線抵抗がほぼ同じになるように巻数が1回目>2回目となり、その比率が1.1~1.4となるよう設定することにより、請求項1で述べた方式と同じ効果を得ることができ、さらに1回目と2回目における巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので寿命の改善も期待できるという効果を奏する。また、今までどおり1回巻、もしくは1回目と2回目の巻数が同数の仕様では巻数は1×8T、1×9Tと整数値でしか表すことができなかったが、1回目と2回目の巻数仕様を変えることで1×8.5T、1×9.5Tと巻線仕様の中を広げることができることで、入力調整を巻線仕様にて行う際、従来に比べ大変有利となる。

【図面の簡単な説明】

【図1】 この発明の実施の形態1を表す整流子電動機の巻線結線図である。

【図2】 この発明の実施の形態1を表す整流子電動機の電機子整流子部上面図である。

【図3】 この発明の実施の形態1を表す整流子結線側面図である。

【図4】 この発明の実施の形態1を表す整流子結線部部分拡大図である。

【図5】 この発明の実施の形態2を表す界磁鉄心と電機子鉄心を上から見た図である。

【図6】 この発明の実施の形態2を表す巻数比率とカーボンブラシの寿命のグラフである。

【図7】 この発明の実施の形態2を表す整流子電動機の側面図である。

【図8】 この発明の実施の形態3を表す電機子巻線の巻線配置を示す結線図である。

【図9】 この発明の実施の形態3を表す位相角のズレとブラシの寿命のグラフである。

【図10】 この発明の実施の形態4を表す整流子電動機の巻線結線図である。

【図11】 この発明の実施の形態4を表す整流子結線部部分拡大図である。

【図12】 この発明の実施の形態5を表す整流子電動機の巻線結線図である。

【図13】 この発明の実施の形態5を表す整流子結線部部分拡大図である。

【図14】 この発明の実施の形態5を表す電機子整流子部上面図である。

【図15】 この発明の実施の形態6を表す整流子電動機の巻線結線図である。

【図16】 この発明の実施の形態6を表す整流子結線部部分拡大図である。

【図17】 この発明の実施の形態7を表す整流子電動機の巻線結線図である。

【図18】 この発明の実施の形態7を表す整流子結線部部分拡大図である。

【図19】 この発明の実施の形態7を表す電機子整流子部上面図である。

【図20】 この発明の実施の形態8を表す電機子整流子部上面図である。

【図21】 この発明の実施の形態9を表す巻数比率と寿命のグラフである。

【図22】 この発明の実施の形態9を表す巻数仕様と入力グラフである。

【図23】 この発明の実施の形態9を表す電機子巻線が巻線された電機子鉄心スロット部の切断拡大図である。

【図24】 この発明の実施の形態10を表す整流子電動機の巻線結線図である。

【図25】 この発明の実施の形態10を表す整流子結線部部分拡大図である。ト切断面図である。

【図26】 従来の整流子電動機の巻線結線図である。

【図27】 従来の整流子電動機の電機子側面図である。

【図28】 従来の整流子電動機の電機子鉄心スロット切断面図である。

【図29】 従来の整流子電動機の整流子結線部部分拡大図である。

【図30】 従来の界磁鉄心と電機子鉄心を上から見た図である。

【図31】 従来の整流子電動機の電機子整流子部上面図である。

【図32】 従来の整流子電動機の電機子整流子部側面図である。

【図33】 従来の整流子電動機の電機子整流子部下面図である。

【図34】 図33の部分拡大図である。

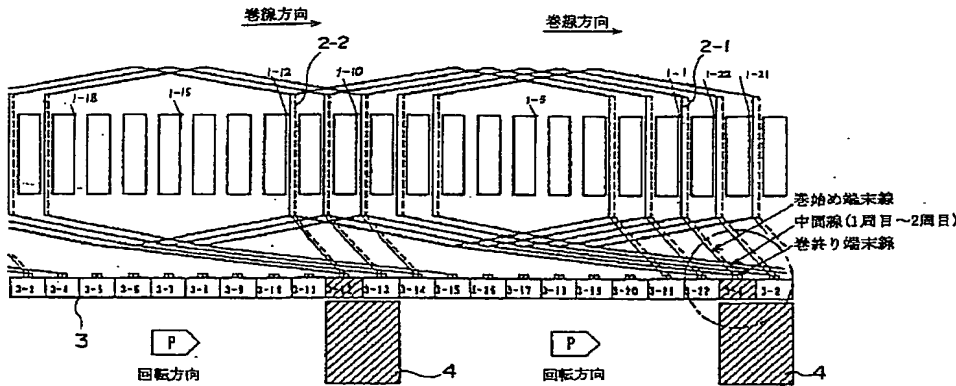
【図35】 電機子巻線を行うフライヤー巻線機の巻線

投入部の図である。

【符号の説明】

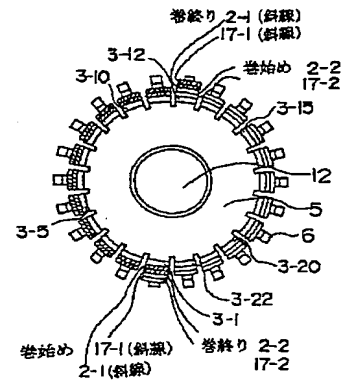
1 電機子鉄心スロット、2 電機子巻線、3 整流子片、5 整流子、7 電機子鉄心、12 回転軸、13 界磁鉄心、14 界磁巻線、19 整流子電動機。

【図1】

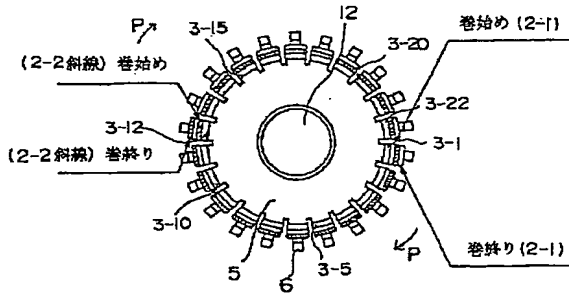


1-1~1-22: 電機子鉄心スロット
2-1~2-22: 電機子巻線
3-1~3-22: 整流子片
4: カーボンブラシ

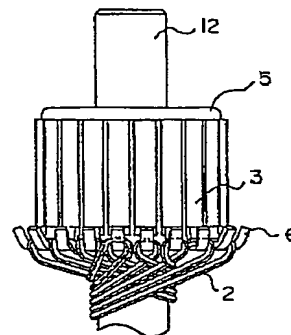
【図14】



【図2】

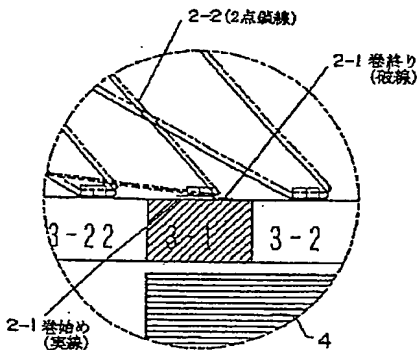


【図3】

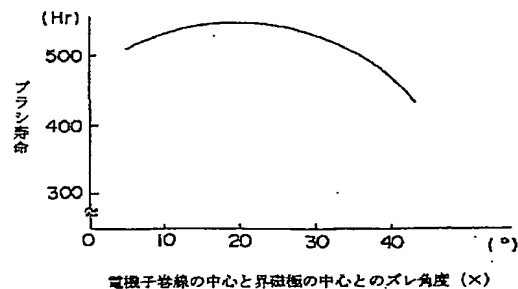


5: 整流子
6: フック部
12: 回転軸

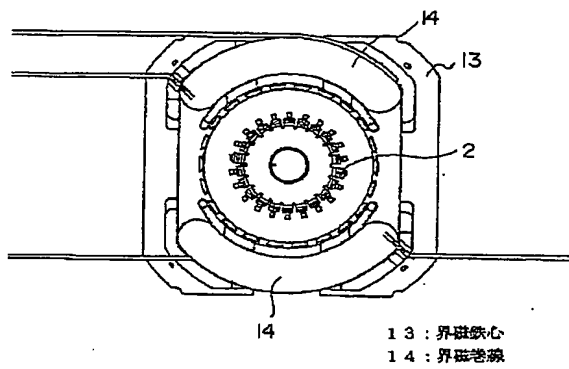
【図4】



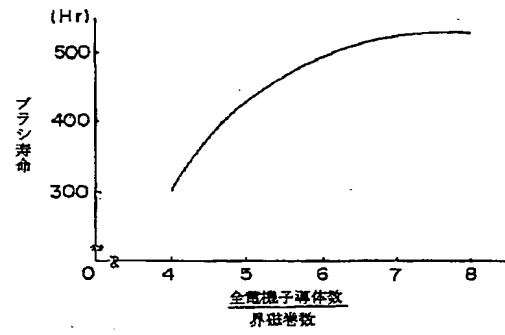
【図9】



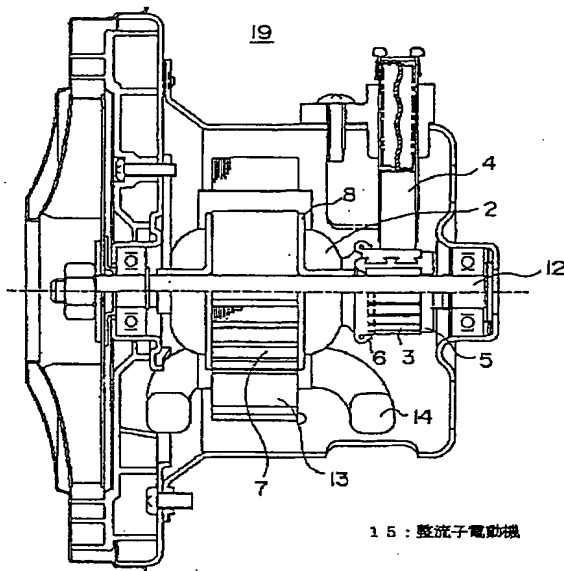
【図5】



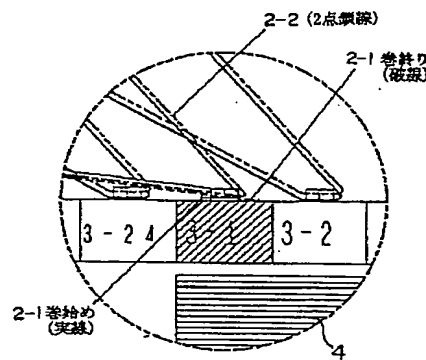
【図6】



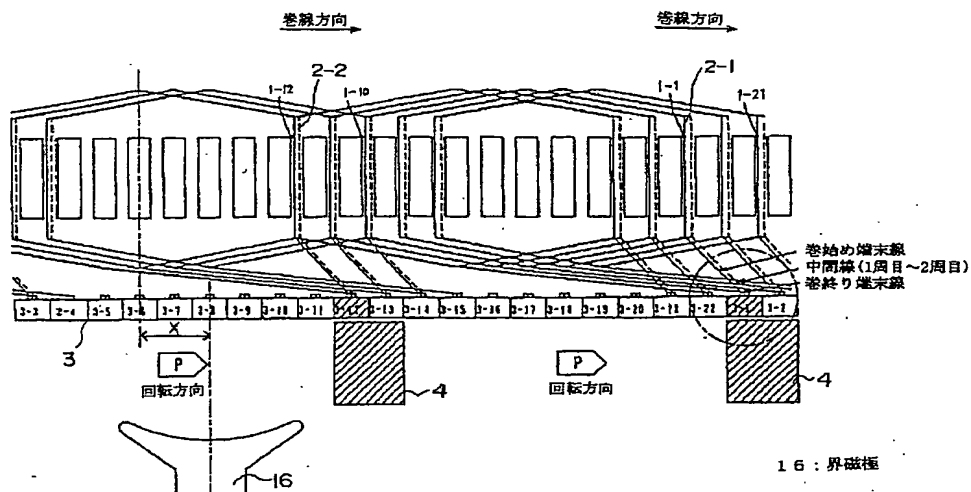
【図7】



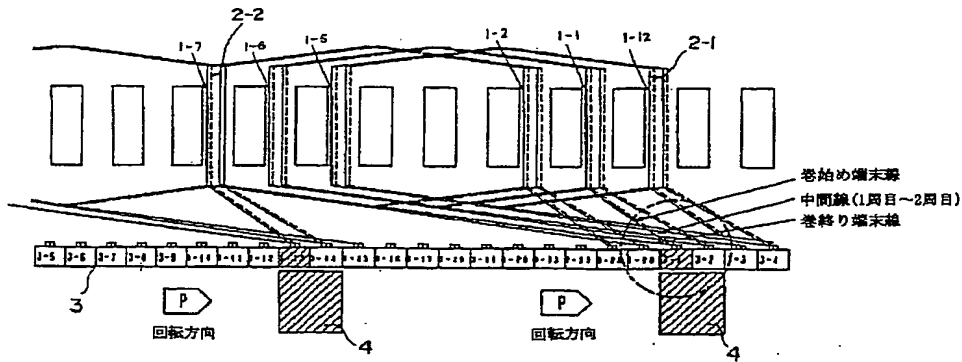
【図11】



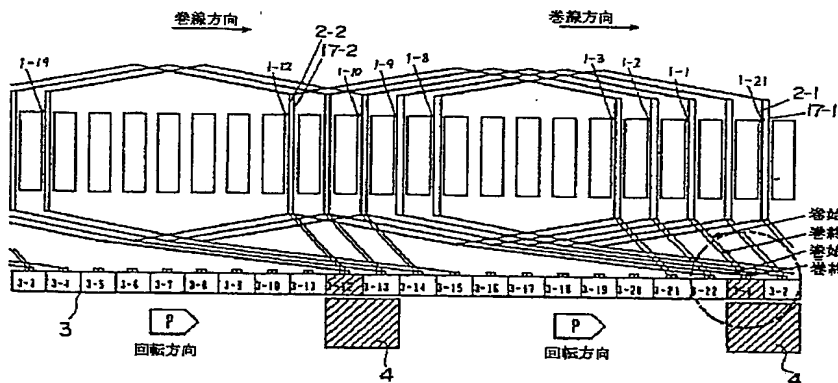
【図8】



【図 10】

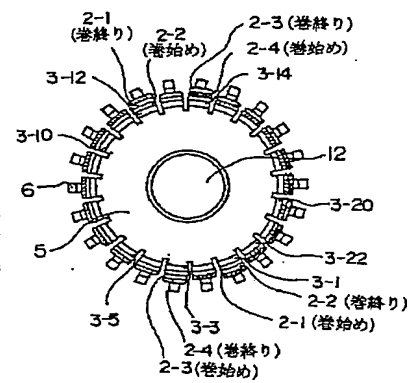


【図 12】

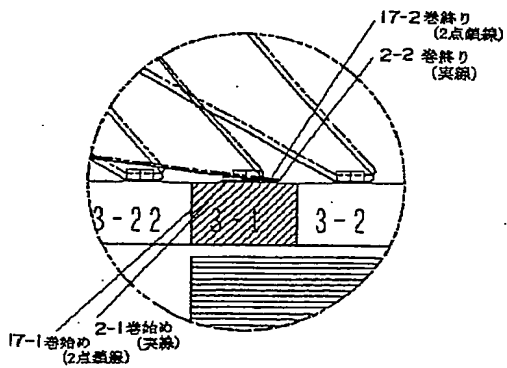


17-1~17-2: 電機子巻線 (並列用)

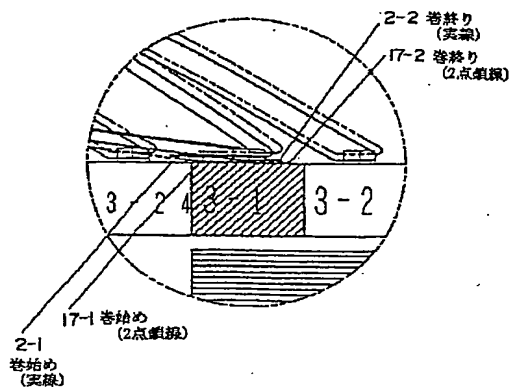
【図 19】



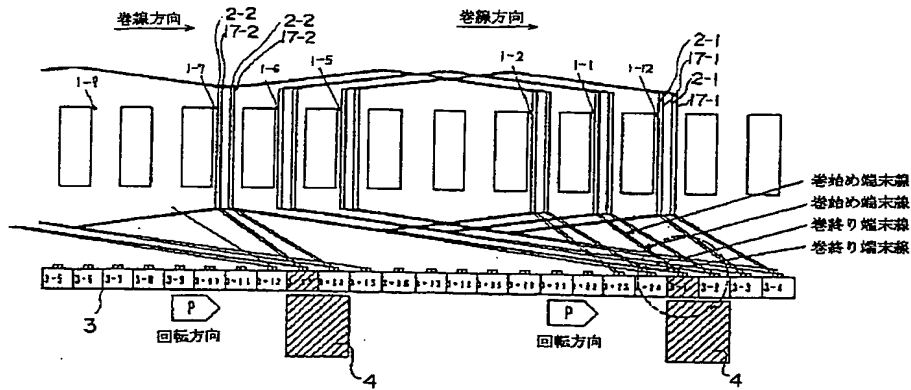
【図 13】



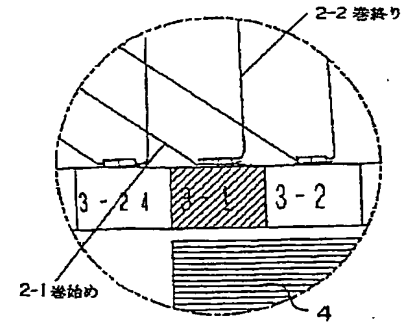
【図 16】



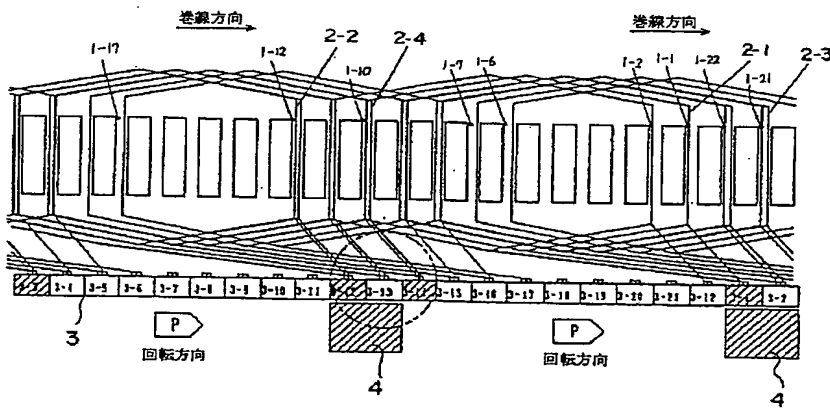
【図15】



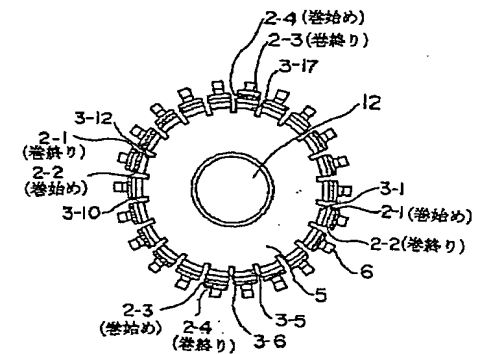
【図29】



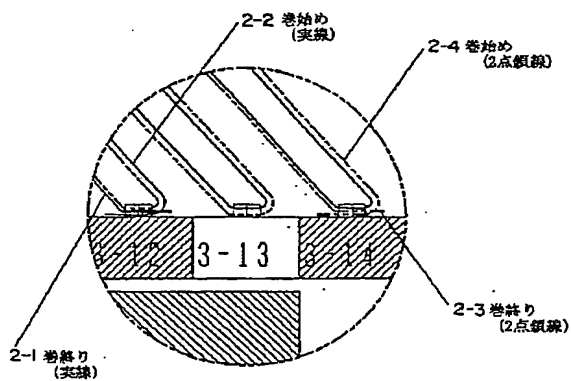
【図17】



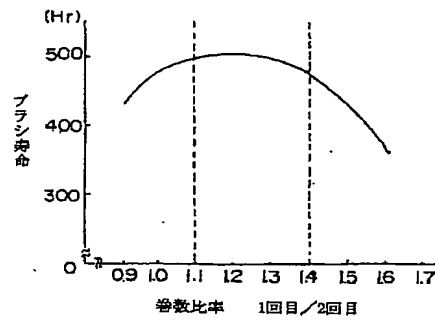
【図20】



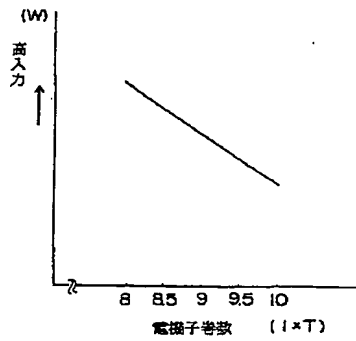
【図18】



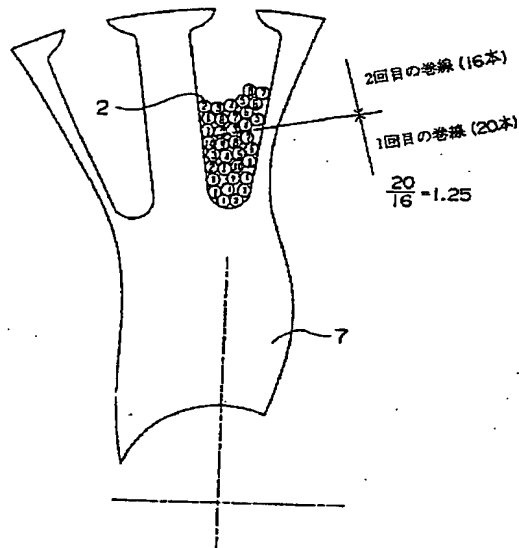
【図21】



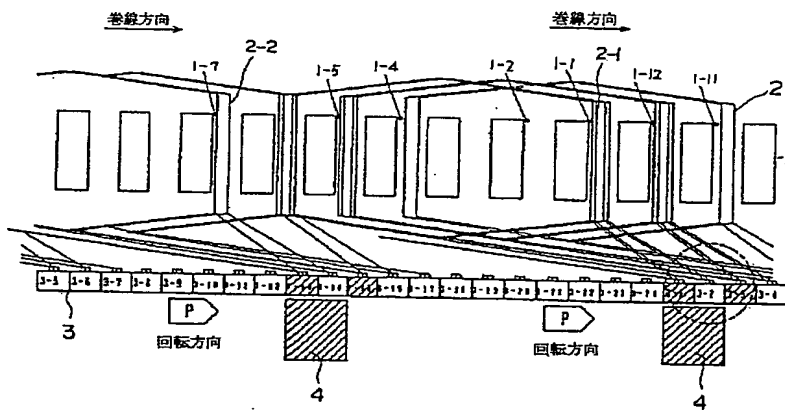
【図 22】



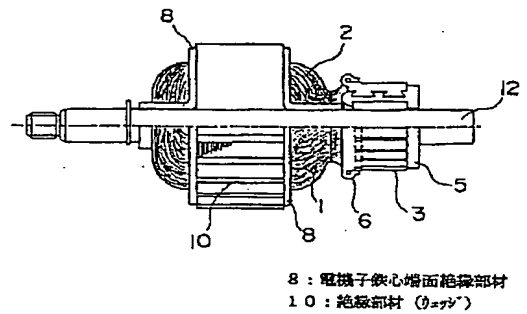
【図 23】



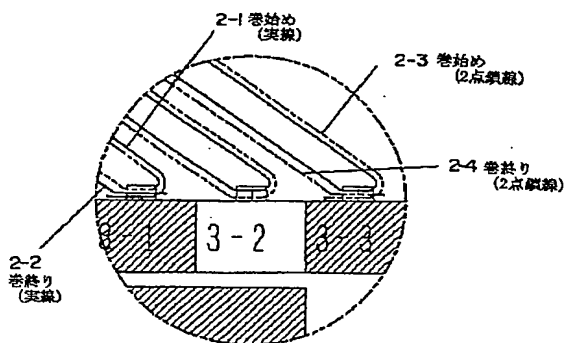
【図 24】



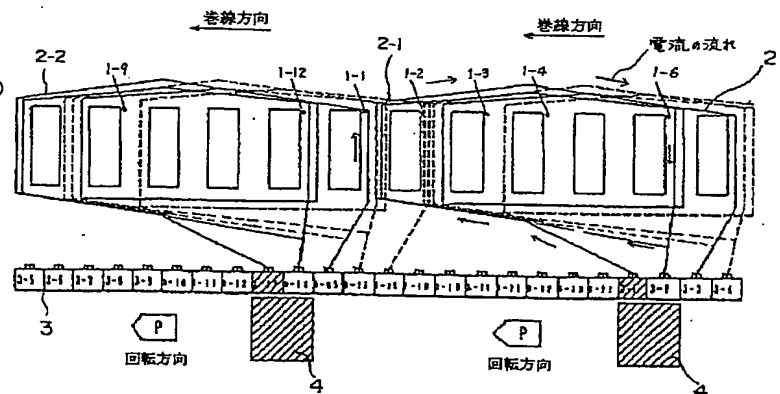
【図 27】



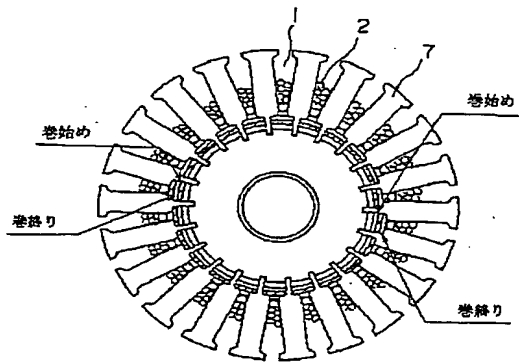
【図 25】



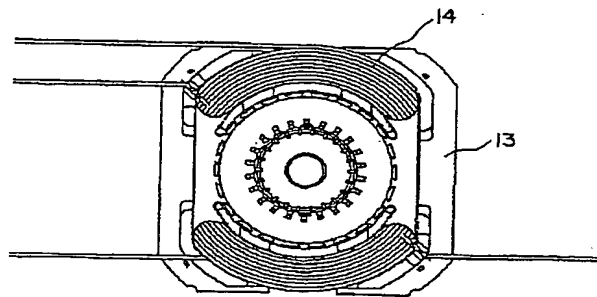
【図 26】



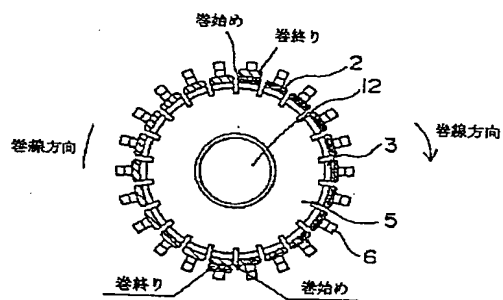
【図28】



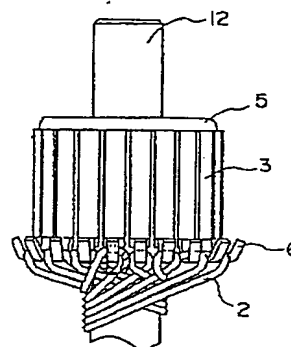
【図30】



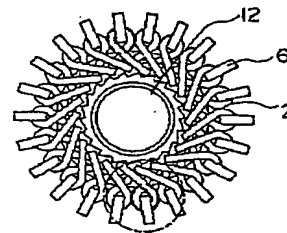
【図31】



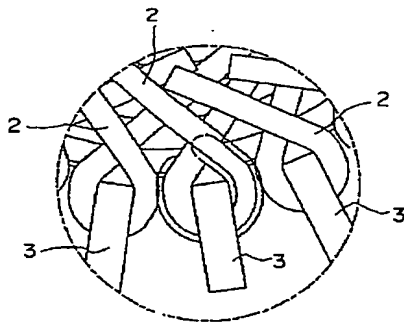
【図32】



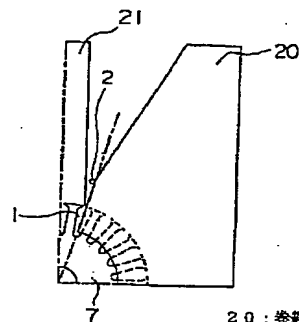
【図33】



【図34】



【図35】



20 : 巻線機フォーム
21 : 巻線機セグメント

フロントページの続き

(72)発明者 新井 光男

埼玉県大里郡花園町大字小前田1728番地1

三菱電機ホーム機器株式会社内